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telephony

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rate of return projections

Rural telcos

GO/NO GO

\$1500 per phone/\$450,000 total

FCC rules

JOINT VENTURES

MAND?

Operating costs

OPPORTUNITY, THREAT

Why this zeal to enlighten others? First, to keep small companies strong since the new technology could replace fixed cable plant service. Second, unless small companies become involved, cellular will be dominated even more than wireline service is today by the large communications groups.

Positive net income

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November 19, 1984

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There are many different factors to consider when planning a cellular mobile system—particularly in a rural setting. And, economics is the bottom line.

Chasing a rural cellular rainbow

LeROY T. CARLSON JR.,
H. DONALD NELSON
and GARY L. HENSHUE

This article on the cellular opportunities for telcos in rural areas is based on a comprehensive study prepared by Telephone & Data Systems, Inc., Chicago. The TDS cellular financial program is available to telephone industry personnel under conditions noted in the article. Also, authors Nelson and Henshue will be happy to answer questions. For more information, call U.S. Cellular Corp. at (312) 696-3500.

IS CELLULAR radio telephone feasible for rural areas?

Telephone and Data Systems (TDS) is comprised of 57 small rural telephone companies, all of which are financed by the Rural Electrification Administration (REA) or are applicants for REA financing. In 1981 TDS, with its small town and rural outlook, saw cellular radio telephone as an opportunity for and a threat to its present and future telephone business. TDS saw it as a way to bring a whole new dimension of personal freedom in communications to its subscribers.

The company took aggressive action to file for cellular licenses wherever the Federal Communications Commission (FCC) Rules requiring telephone wireline presence would

allow TDS to do so. Thus far, this has involved filing for 13 markets. TDS will be the operating partner in two of these markets: the standard metropolitan statistical area (SMSA) surrounding Tulsa, Okla., and the SMSA surrounding Knoxville, Tenn. TDS also has a minority position in 11 other markets, from a high of 49% in Nashville, Tenn., to 1.9% in Fresno, Calif.

Five applications were filed on July 16, 1984, in markets 91-120.

The corporate management team made an early decision to keep other small telephone companies fully informed on the great potential of cellular. TDS executives have made numerous presentations to the United States Telephone Assn. (USTA) and state association con-

LeRoy T. Carlson Jr. is President of Telephone and Data Systems, Inc. (TDS), Chicago. H. Donald Nelson is Executive Vice President and Gary L. Henshue is Manager of Finance of U.S. Cellular Corp., a subsidiary of TDS based in Park Ridge, Ill., a suburb of Chicago.

	A Northeastern State		A Southern State	
Prominent Industries w/ Constant Interact	-Construction -Agriculture -Manufacturing	-Retail -Wholesale	-Construction -Manufacturing -Transport	-Wholesale -Retail
Job Title	President - Owner - Manager		President - Owner - Manager	
Business Size	76% Less than 10 employees		69% Less than 10 employees	
Travel Away From Office	78% More than 1 hour per day 75% More than 25 miles per day		68% More than 1 hour per day 68% More than 25 miles per day	
Distance Called	Local 46.2% Local + Toll 13.8 Intrastate Local 23.7 Intrastate L.S. 13.4 International 4		71.9% 4.4 18.4 9.1 9.3	
Roaming	98% travel more than 9 times per month to other major cities 33% would subscribe to roaming 1.9 calls per day		37% travel more than 9 times per month 87% would subscribe to roaming 6.9 calls per day	
Product	67% prefer mobile/portable unit		63% prefer mobile/portable unit	

FIG. 1 Cellular rural user profile.

ventions about cellular radio's future and how a small company can become a part of it.

Why this zeal to enlighten others? First, the small companies in the industry must stay strong because the new technology could replace today's fixed cable plant service. Second, unless small companies become involved, cellular will be dominated even more than wireline service is today by the large communications groups. Third, TDS wants to offer its services to small companies which are interested in cellular, but which prefer to pursue it with a knowledgeable joint venture partner, a partner from their own industry.

It is, of course, more important to emphasize the opportunities presented by cellular, rather than the threats.

The opportunities include:

- There is substantial new radio spectrum availability. Never before has the FCC given one company even close to 333 frequencies to use to provide customer services.
- There is far better service to new and existing customers, with quality equal to or better than landline, plus mobility and privacy.
- There is a competitive environment to build for the future. The cost of service is expected to decline substantially through the use of micro-electronics in customer units.

TDS has a broad, positive view of the future of telecommunications, a view which foresees a major role for cellular.

Believing in both the opportunity of cellular and in its potential threat to current landline technology, TDS has aggressively planned to file for more than 70 additional metropolitan sta-

tistical area (MSA) and non-MSA areas.

Many small telephone companies are unwilling to file for the cellular market in their geographic area unless they have a knowledgeable, resourceful partner that is truly concerned with the small company's needs and which can assist the small company in market research, financial analysis, system design, negotiation with other filers, system construction, system marketing and system operation.

TDS realizes that a small company will be better off controlling its own cellular system than being consigned a very small minority investor interest in a system dominated by one of the industry giants. Almost 30 TDS filings will involve this type of joint venture; some are with telephone co-operatives and others are with family owned telephone companies. In each case, the small telephone company is the 51% or greater majority partner; and TDS is the minority partner providing substantial assistance. The right to file under FCC rules for the cellular radio telephone license is the small telephone company's birthright; once it's gone, it's gone forever. It's only a valuable birthright if the telephone company with the presence files for the market on the appropriate date. TDS believes that SMSAs (or, as they are now called, MSAs) and many non-MSAs which are properly equipped and tightly managed will be profitable. Which non-MSAs will be profitable or feasible?

While there are 175 more MSAs still to be filed after July 16, 1984, which telcos should examine carefully, there is a much greater number

of non-MSA areas. The discussion now will focus on the non-MSAs, although everything in the financial model can be used for MSA markets as well.

Rules

The FCC non-MSA rules adopted May 17, 1984, state simply:

- wireline set aside remains for filing;
- a maximum of 2000 square miles can be filed for per filing;
- one-day filing (probably in 1986);
- major towns to be listed;
- lottery will be used; and
- uncontested wireline geography will be thereafter opened to non-wireline companies at later date.

It is quite possible that the FCC will change or revise the rules, but for now everyone must plan on using these assumptions.

Telcos should have some idea as to general cellular costs in order to choose initial service areas wisely. The costs of the cellular switch, cell site controllers and radio equipment all must be considered. Small market switches and cell site equipment on a turnkey basis sized for 300 cellular phones will be available for less than \$450,000, or \$1500 per phone. Both technology and costs are within this range today and improvements can be anticipated. However, there are more than system equipment costs that need to be considered. For example, there is now sufficient information on subscriber equipment to foresee the strong possibility of a \$1000 mobile equipment retail price by the time the non-MSAs are on the air. Subscriber equipment prices are falling rapidly.

Analysis and planning are the keys

to a successful cellular radio telephone business. To achieve a high level of understanding and reasonable accuracy for a profitable decision, TDS' cellular market analysis follows these five basic steps:

- determine the demand for cellular service in the proposed service area;

- develop an engineering plan;
- integrate the demand study with the engineering plan;

- obtain equipment cost quotations from vendors; and

- analyze the financial consequences of all of the previous four steps.

With the IBM personal computer model TDS has put together, the company can illustrate how to work with proposed service areas and figure the financial feasibility of a cellular radio telephone system. This model and a descriptive user booklet will be made available to small telephone companies and cooperatives at

the nominal price of \$300, which is less than cost, in the interest of ensuring the future of the companies. The model also will be available without charge to the REA and to those companies which elect to have TDS as a joint venture partner. Users will also need access to Lotus 1-2-3 software to run the model.

Demand study

Using its general cellular expertise, TDS makes a preliminary definition of a potential cellular service area and a rough outline of the several cells comprising it. Then a demand study is made.

A great deal of data exists that can aid in determining demand. TDS does not have all of the data resources within the company necessary to compile an accurate marketing study, so Arthur D. Little, a consulting firm, has been chosen to help in determining the demand for cellular radio telephone service in each geographic

area. With more than 70 individual demand studies completed, TDS has learned what is available, what is useful and how to establish a reasonable, cost effective method of determining the number of cellular radio telephone subscribers in year 1 through year 10.

Two information sources which are available do not require an outside consultant. They are state maps and U.S. government census tract data. Both are useful when non-MSAs are considered because the data is available on a county-wide basis.

The 1980 census data by census tract has proven to be very useful and is available from government sources on a statistical basis and from several sources on a map overlay basis. Combining the 1980 census with earlier data helps to project growth through 1984 and also for the next 5 to 10 years, the period of the cellular feasi-

Continued on page 36

FIG. 2 Request for equipment quotation.

MARKET NUMBER										
	Subscribers	SWITCH	CELL 1	CELL 2	CELL 3	CELL 4	CELL 5	CELL 6	CELL 7	TOTAL
Year 3	Channels									
Year 5	Channels									
Height										
Control Switching Equipment										
Cell Site Equipment										
Cell Site Buildings										
Antennas & Cables										
Engineering & Installation										
Spares & Maintenance Tools										
Test Equipment										
Documentation										
Training										
Power & Battery										
Other										
TOTAL										
GRAND TOTAL										
* Includes 1 control channel per site										

* Includes 1 control channel per site

STUDY SUBJECT..... LOW COST NON-MSA
STUDY DATE..... 06/29/84
PREPARED BY..... ULN
EQUIPMENT SUPPLIER.. LOW COST DOMESTIC SUPPLIES
REV 04/84

LINE NO.	NON-MSA DESCRIPTION	TOTAL CELLULAR DEMAND (1)					ESTIMATED 1989 POPULATION	ESTIMATED 1989 EMPLOYMENT	1989 DEMAND/POPULATION	1989 DEMAND/EMPLOYMENT	NUMBER OF PROPOSED CELLS	NUMBER OF SQ. MILES	1989 POP. DENSITY PER CELL	1989 POP. DENSITY PER SQ. MILE	LINE NO.
		1985	1986	1987	1988	1989	(h)	(i)	(j)	(k)			(m)	(n)	
1.	MARKET A	227	313	476	710	947	126,735	46,953	0.45	2.46	3	930	60,378	130	1.
2.	MARKET B	792	926	1,404	2,105	2,807	223,182	107,133	1.33	2.61	4	2,000	55,776	112	2.
3.	MARKET C	187	247	374	560	747	86,253	32,494	0.91	2.31	3	1,331	26,730	45	3.
4.	MARKET D	126	158	240	359	479	47,195	21,712	1.06	2.32	2	1,104	33,598	43	4.
5.	MARKET E	293	386	585	877	1,149	85,391	42,110	1.41	2.81	2	594	41,640	100	5.
6.	MARKET F	563	743	1,125	1,680	2,250	173,740	82,938	1.33	2.71	4	1,412	43,842	100	6.
7.	MARKET G	457	603	914	1,371	1,870	148,475	75,104	1.22	2.41	3	1,110	49,492	133	7.
8.	TOTAL	2,557	3,375	5,114	7,670	10,227	882,799	408,641			20	8,491	363,667	730	8.
9.	AVERAGE CELLULAR DEMAND	343	462	731	1,096	1,461	126,119	58,370	1.32	2.52	2.9	1,282	44,100	101.6	9.
10.	AVERAGE WIRELINE CELLULAR DEMAND	183	241	363	540	731			0.45	1.32					
11.	AVERAGE INVESTMENT PER WIRELINE CUSTOMER	95,302	94,016	87,651	81,767	81,225									

(1) BASED ON A.D. LITTLE MARKET STUDIES.

FIG. 3 The results of cellular market demand studies for seven non-MSA markets.

bility study. Much more could be said about this area, but telcos should consult specialists; they will save time and money.

TDS has chartered A. D. Little to make a telephone survey of potential users for every market filing it has done. This is at an additional cost but is well worth the expense since it is an important key to understanding the feasibility and demand differences by market. Studies show that initial cellular demand can vary from as low as 1.5% to as high as 3.5% of employment, which are vast differences. In planning a system, TDS prefers to know as much as possible because new market development uncertainties and substantial dollar commitments are involved.

A brief outline of the telephone interview procedure and the elements that appear most useful will be interesting. Through its opinion research subsidiary in Princeton, N.J., A. D. Little calls businesses from a sample drawn using SICs, or standard industrial codes. More than 200 codes and sub-codes have proven to be potential cellular radio telephone users.

Is there a difference from urban to

rural? Yes. Is there a regional difference from Northeast to Midwest to Southwest? Again, the answer is yes.

The 10 to 15 minute telephone interview is aimed at persons who are away from a phone 2 hours or more per day and seeks to determine three key things:

- what telephone usage would be if a cellular phone were available;
- price levels people are willing to pay; and
- travel patterns.

Many more facets are learned through this study. Respondents want to discuss their telecommunications needs and wants, to understand the concept of cellular and to express their price/usage trade-off relationships. Interviewees consistently demonstrate a strong desire for cellular as a tool to improve their productivity.

The data obtained in the interview, the map studies and the census tract data is reduced to potential subscribers per cell. One caution which must be considered is that the subscriber has a home and, for consistency, that is where TDS locates him or her. The

problem, of course, is that the driveway is not the principle place of use for a cellular telephone. Thus, A. D. Little has developed a model based upon all the related elements to adjust for actual location usage.

A user profile using data from A. D. Little studies of two different geographic areas, one in the Northeast and the other in the Southeast, is shown in Figure 1.

The engineering plan is familiar to all telcos. Included is the radio transmission and propagation plan for the geographic area, which is most often represented by the Carey curve circles on the 250 mile map of the area. Radio transmission is different and less predictable than landline transmission. Having the best possible knowledge of the actual radio radiation pattern is paramount to designing a good system. Based on the demand study, the initial service area and cell locations are reviewed and, if need be, revised, sometimes substantially, to provide optimal coverage in the highest traffic areas and continuous coverage within the overall service area while still observing such

Continued on page 41

engineering design concepts as grid patterning to ensure future efficiency as the system demand grows and cell splitting occurs.

This integration of the market demand study with the engineering plan requires considerable talent and skill. The number of subscribers per cell leads to the number of channels per cell, which leads to the cell size and sites, and then to central switch and system capacity. While a first year plan by cell site and for the system is necessary so is a model that takes population, technology and service into consideration over a longer period; thus, demand forecasts and engineering plans are integrated year by year into a 10-year plan with subscribers per cell. With the detail now completed as to number of cells,

number of subscribers by cell, tower heights, terrain considerations and levels of service, initial equipment quotations can be obtained. Final equipment prices will be subject to much hard bargaining after a license has been granted.

Telcos will only get what they ask for from some manufacturers when they ask for equipment quotations, so it is important to be very specific. TDS has a team that is primarily focused on marketing and operating cellular systems. Thus, the company depends heavily on vendors for constructing the systems. Manufacturers therefore, are expected to provide turnkey cellular telephone systems. The format TDS uses to request budgetary equipment costs for MSA and non-MSA markets is shown in Figure

2. It was developed to avoid an excessive variety of interpretations. It's simple and encompassing, and it makes two or more equipment quotations comparable.

TDS requests equipment costs through year 3 and year 5. Trends toward lower costs of switching and cell site equipment, and substantially lower prices for subscriber units, may cause subscriber demand to quickly grow higher than the forecasted year 1 level. The service provider must have sufficient system capacity to maintain top quality service levels if this occurs.

TDS also requests these two points in time for equipment costs because some manufacturers have system designs where the cost of equipment and memory are primarily in the orig-

FIG. 4 The cellular plant construction costs for 17 different plant categories.

STUDY SUBJECT.....		LOW COST NON-MSA									
STUDY DATE.....		09/29/84									
PREPARED BY.....		GLN									
EQUIPMENT SUPPLIER..		LOW COST DOMESTIC SUPPLIER									
REV 10/84											
		NON-MSA DESCRIPTION								OVERAGE	
LINE NO.	PLANT CATEGORY	MARKET A	MARKET B	MARKET C	MARKET D	MARKET E	MARKET F	MARKET G	TOTAL	COST	LINE NO.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
1.	LAND										
	-EASEMENTS (1)	\$13,072	\$26,144	\$19,608	\$13,072	\$13,072	\$26,144	\$19,608	\$130,720	\$19,674	1.
2.	BUILDINGS										
	-CELL SITE	\$0,060	\$121,720	\$120,000	\$0,000	\$0,000	\$140,000	\$120,000	\$42,580	\$14,083	2.
3.	-OFFICE	0	0	0	0	0	0	0	0	0	3.
4.	CONTROL SWITCHING EQUIPMENT (INTSD) (2)	\$145,000	\$290,000	\$191,000	\$140,000	\$184,000	\$305,000	\$241,000	\$1,534,000	\$219,143	4.
5.	CELL SITE EQUIPMENT	\$142,300	\$45,100	\$87,950	\$129,000	\$110,000	\$34,600	\$89,200	\$1,739,750	\$248,536	5.
6.	-ANTENNAS & CABLES	\$10,500	\$1,000	\$15,750	\$10,500	\$10,500	\$1,000	\$15,750	\$195,000	\$15,000	6.
7.	TEST EQUIPMENT	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$24,000	\$174,000	\$24,057	7.
8.	TRANSMISSION-DIGITAL CARRIER (3)	\$25,466	\$0,932	\$8,199	\$25,466	\$25,466	\$0,932	\$8,199	\$254,660	\$6,380	8.
9.	VEHICLES (\$15,000 PER UNIT)	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$210,000	\$30,000	9.
10.	SPARES, MAINTENANCE, TOOLS	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$140,000	\$20,000	10.
11.	OFFICE FURNITURE & EQUIPMENT	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$280,000	\$40,000	11.
12.	OTHER										
	-GENERAL	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$140,000	\$20,000	12.
13.	-DOCUMENTS	0	0	0	0	0	0	0	0	0	13.
14.	-TRAINING	\$6,000	\$0,000	\$7,000	\$6,000	\$6,000	\$0,000	\$7,000	\$10,000	\$6,007	14.
15.	-ENGINEERING & INSTALLATION	\$17,000	\$1,500	\$6,000	\$17,500	\$10,500	\$105,500	\$0,000	\$171,000	\$17,206	15.
16.	-POWER & BATTERY (4)	\$10,900	\$9,700	\$1,500	\$16,500	\$1,700	\$49,100	\$1,100	\$191,500	\$27,357	16.
17.	MISCELLANEOUS & CONTINGENCIES	10.000	\$4,010	\$15,210	\$9,201	\$6,484	\$24,728	\$7,486	\$115,123	\$18,017	17.
18.	TOTAL CONSTRUCTION COSTS (5)	\$794,100	\$1,267,306	\$971,200	\$645,522	\$822,842	\$1,372,004	\$1,074,543	\$6,777,331	\$968,190	18.
19.	NUMBER OF PROPOSED CELLS	2	4	3	2	2	4	3	20	2.9	19.
20.	INVESTMENT PER CELL WITH INTSD	\$397,054	\$316,826	\$324,400	\$322,761	\$411,421	\$342,501	\$358,181	\$338,867		20.
21.	INVESTMENT PER CELL WITHOUT INTSD	\$269,054	\$242,076	\$226,736	\$250,661	\$319,421	\$266,751	\$277,848	\$262,167		21.
(1) BASED ON AVERAGE OF \$6,536 PER CELL.											
(2) INCLUDES ONE CONTROL CHANNEL PER SITE.											
(3) BASED ON AVERAGE OF \$12,733 PER CELL.											
(4) FOUR HOURS AT CELL SITE AND SWITCH.											
(5) BASED ON PRICE QUOTES FROM LOW COST DOMESTIC SUPPLIER, EXCEPT FOR EASEMENTS, BUILDINGS, DIGITAL CARR., VEHICLES, OFFICE EQUIP., AND CONTINGENCIES.											

STUDY SUBJECT..... LOW COST NON-MSA
 STUDY DATE..... 06/29/84
 PREPARED BY..... SLA
 EQUIPMENT SUPPLIER..... LOW COST INDIAN SUPPLIER
 REV 05/84

LINE NO.	PRE-OPERATION COSTS	NUMBER	SALARY	ANNUAL COSTS	MONTHS OF OPERATION			ESTIMATED OPERATING COSTS			TOTAL NUMBER	LINE NO.
					CONSTR. YR.	YEAR 1	YEAR 2	CONSTR. YR.	YEAR 1	YEAR 2		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
1.	PAYROLL AND OVERHEADS—PERCENT	40.0%										
2.	MANAGEMENT—GENERAL MANAGER	0	90	90	12	12	12	90	90	90		1.
3.	—TECHNICAL MANAGER	1	625,000	35,000	12	12	12	35,000	35,000	35,000		2.
4.	SECRETARY/CLERK	1	615,000	21,000	6	12	12	10,500	21,000	21,000		3.
5.	SALES AND MARKETING—TOL. COMM.											4.
6.	—MANAGER	1	620,000	29,000	3	12	12	7,000	29,000	29,000		5.
7.	—SALES/OPERATIONS	0	90	0	3	12	12	0	0	0		6.
8.	TECHNICIAN	0	90	0	6	12	12	0	0	0		7.
9.	ADMINISTRATIVE SUPPORT	1	615,000	21,000	3	12	12	5,250	21,000	21,000		8.
10.	OTHER PAYROLL COSTS—PERCENT	10.0%		10,500				5,775	10,500	10,500		9.
11.	TOTAL PAYROLL AND OVERHEADS			615,500				663,525	615,500	615,500		10.
12.	TEL. CIRCUIT COSTS (6 614,000/CALL)	2.9		946,857	3	12	12	19,324	46,857	46,857		11.
13.	CELL SITE RENTAL			0				0	0	0		12.
14.	HEAT & LIGHT—SYSTEM (1002,000/CALL)	2.9		5,714	3	12	12	2,381	5,714	5,714		13.
15.	HEAT, LIGHT & REPAIR—SALES OFFICE			23,600	6	12	12	11,800	23,600	23,600		14.
16.	AMPHIBIOUS AND OTHER SALES											
17.	CONSTR. YR. 1—6200/CUSTOMER			42,636	6	6		22,820	22,820	0		15.
18.	YEAR 1—6200/CUSTOMER			60,284		6		0	30,133	30,133		16.
19.	YEAR 2—10—6200/CUSTOMER			73,050			6	0	0	36,325		17.
20.	OTHER OPERATING COSTS—PERCENT	20.0%		47,482				24,920	48,943	31,682		18.
21.	DEPRECIATION & AMORTIZATION			110,753	0	12	12	0	110,753	110,110		19.
22.	EST. LIFE	10										20.
23.	SUBTOTAL			6200,142				680,592	6200,900	6310,702		21.
24.	TOTAL OPERATING COSTS			6295,642				6146,117	6404,400	6426,202		22.
25.	LESS INDEBT CAPITALIZED				12	0	0	146,117	0	0	146,100	23.
26.	TOTAL OPERATING COSTS EXPENSED							90	6404,400	6426,202		24.
27.	CAPITALIZED INTEREST DURING PRE-OPERATION (CONSTR. YR. 1) PERCENT	15.5%			12	0	0	877,174	90	90	77,200	25.
28.	SUMMARY OF CAPITALIZED COSTS:											
29.	CONSTRUCTION COSTS							9968,190	90	90	960,200	26.
30.	OPERATING COSTS (INDEBTED CONSTR. COSTS)							146,117	0	0	144,100	27.
31.	INTEREST DURING CONSTRUCTION							77,174	0	0	77,200	28.
32.	TOTAL CAPITALIZED COSTS							91,109,481	90	90	1,109,500	29.
33.	FIRST FULL YEAR OPERATING COSTS—											
34.	OPERATIONS (EXCLUDES NON-CASH CHARGE FOR DEPRECIATION)								6293,635	293,700		30.
35.	INTEREST EXPENSE	15.5%							160,563	160,600		31.
36.	GRAND TOTAL FINANCIAL REQUIREMENTS										91,643,800	32.

FIG. 5 The operating costs for non-MSA cellular system for the first 2 years of operation.

inal installation; while others have distributed systems where the memory and some equipment is decentralized and, thus, have lower first costs with higher expansion costs.

Questions that are very important to ask are: what are the channel costs and how long will delivery of channel banks be from date of order? Quarterly prices for channel cards are available, so it also is important to ask about these prices.

How are all of these factors tied together in a cellular model using best estimates of demand, costs and the competitive environment?

The rest of this article will guide the reader through the cellular system financial planning model that will provide the quantitative data a telco needs to estimate the feasibility of

cellular for a given rural area. 1-2-3 program and TDS cellular model diskette will be the basic tools. [This discussion is based on an original document prepared by TDS which included 22 pages of supplementary material, most of which are referred to as "exhibits." This article uses seven of the exhibits and designates them "figures." Among the most important exhibits which are not used in this article are exhibits with information on construction payment schedules, cellular prices and usage, projected customers and revenue data, and projected investment and financing data.]

Figure 3 summarizes the results of cellular market demand studies prepared by A.D. Little for TDS for seven non-MSA markets. These mar-

kets are typical of the market areas the TDS companies and its joint ventures plan to file for in the non-MSA cellular round of filings. The total cellular demand (wireline and non-wireline) in units (mobile and portable) combined for years 1-5 (1985-1989) is shown by market in columns (C) through (G) on lines 1 through 7. There are wide variations from market to market in total demand. Columns (H) and (I) show the estimated 1989 population and employment for the seven non-MSA cellular markets. Again, there are wide variations and the relationship between population and employment varies from market to market. Columns (J) and (K) reflect calculations that take the year 5 (1989) estimated cellular demand and

Continued on page 46

divide this by the estimated population and employment. Column (L) shows the proposed number of cells for each market. Column (M) shows the total square miles for the portion of the counties included in each cell service area for the total of all cells. Column (N) calculates the density of the estimated 1989 population per cell. This calculation is column (H) divided by column (L). This density ranges from a high of 60,378 population per cell to a low of 23,598 population per cell. Column (O) calculates the density per square mile of the 1989 population. The calculation takes column (H) and divides it by column (M). As can be seen in column (O), the population density per square mile for the seven markets ranged from 43 per square mile to 140 per square mile.

Line 9 in Figure 3 calculates the averages for columns (C) through (O) for the seven non-MSA markets. Columns (C) through (G) show average total demand rising from 365 units in

the first year to 1461 units in the fifth year. As calculated on line 9 of column (H) and (I), the average population and employment in the non-MSA's analyzed is 126,114 and 58,378, respectively. Of particular significance are columns (J) and (K) on this line. They show that in the year 1989, it is estimated that 1.2% of the total population and 2.5% of those employed in these seven markets will demand cellular radio service. The averages for these markets are in line with the results A.D. Little obtained in its studies of the top 90 markets. A word of caution: it is possible to be misled by averages and they should never be applied to any specific market. TDS has seen market research showing figures ranging from 0.7% to 1.7% for demand as a percentage of population and from 1.5% to 3.5% for demand as a percentage of employment. Market research specific to a particular market should always be obtained before designing a system. The last four columns on line 9 also

are instructive. They show that the average system has 2.9 cells, covers 1242 square miles and has population densities of 44,140 per cell and 101.6 per square mile.

Line 10 of Figure 3 shows the estimated average wireline cellular demand for year 1-5. These demand numbers are calculated by taking 50% of the total cellular demand, as shown on line 9. This assumes that the total customer base is split 50% wireline and 50% non-wireline. Thus, in year 1 it is anticipated that the wireline company in an average market would provide service to 183 customers; year 2, to 241 customers; and in year 5, to 731 customers.

On line 11 of Figure 3, the average cellular plant investment per wireline customer has been calculated using data shown in Figure 4. This excludes customer equipment. The calculation takes the average construction costs from column (K), line 18 Figure 4 for the low cost domestic supplier and

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FIG. 6 A look at the financial feasibility of cellular radio in rural areas.

STUDY SUBJECT.....		LOW COST NON-MSA												
STUDY DATE.....		06/29/84												
PREPARED BY.....		DLM												
EQUIPMENT SUPPLIER..		LOW COST DOMESTIC SUPPLIER												
REV 06/84														
LINE NO.	DESCRIPTION	CONSTR. YR.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL	LINE NO.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
OTHER ASSUMPTIONS-														
1.	INCOME TAX RATE.....	50.01	50.01	50.01	50.01	50.01	50.01	50.01	50.01	50.01	50.01	50.01	50.01	1.
2.	INFLATION RATE.....	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	2.
3.	CUSTOMER SERVICES COST PER UNIT....	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	3.
INCOME STATEMENT-														
4.	REVENUES.....	00	\$136,676	\$309,829	\$444,187	\$668,869	\$934,985	\$1,175,792	\$1,408,443	\$1,640,131	\$2,028,150	\$2,433,789		4.
OPERATING EXPENSES....														
5.	PAYROLL AND OVERHEAD	00	\$115,500	\$115,500	\$121,275	\$127,339	\$133,706	\$140,391	\$147,411	\$154,781	\$162,320	\$170,446		5.
6.	CUSTOMER SERVICES	0	1,141	2,440	3,789	5,787	7,990	10,844	12,853	14,444	17,337	20,820		6.
7.	ADVERTISING	0	52,941	46,650	47,991	73,491	77,145	81,823	85,875	89,328	93,795	98,484		7.
8.	TEL. CIRCUIT COSTS	0	46,857	46,857	47,200	51,640	54,343	56,953	59,603	62,785	65,933	67,229		8.
9.	CELL SITE RENTAL	0	0	0	0	0	0	0	0	0	0	0		9.
10.	UTILITIES	0	29,394	29,394	30,864	32,407	34,028	35,729	37,515	39,391	41,361	43,429		10.
11.	OTHER OPERATING	0	48,943	51,482	54,264	56,779	59,828	63,420	65,941	69,259	72,722	76,380		11.
12.	TOTAL OPER. COSTS	00	\$294,797	\$312,740	\$329,286	\$347,585	\$366,599	\$386,462	\$407,817	\$430,616	\$455,687	\$478,974		12.
13.	DEPRECIATION.....	00	\$107,150	\$112,587	\$118,133	\$124,839	\$130,241	\$136,753	\$143,391	\$150,771	\$158,389	\$166,225		13.
14.	AMORTIZATION.....	0	3,463	3,463	3,463	3,463	3,463	3,463	3,463	3,463	3,463	3,463		14.
15.	NET OPER. INCOME BEFORE INCOME TAXES..	00	(\$248,854)	(\$119,621)	146,934	\$195,644	\$434,151	\$646,380	\$853,632	\$1,195,742	\$1,412,389	\$1,784,987		15.
16.	INTEREST COST.....	00	\$98,445	\$102,804	\$93,397	\$84,613	\$74,882	\$63,636	\$52,804	\$41,915	\$29,742	\$31,229		16.
17.	TAXABLE INCOME.....	00	(\$367,318)	(\$221,825)	(\$100,531)	\$109,631	\$360,119	\$582,747	\$806,628	\$1,064,229	\$1,382,617	\$1,753,759		17.
18.	INCOME TAXES	00	00	00	00	\$54,816	\$180,040	\$291,374	\$480,314	\$532,114	\$691,609	\$874,879		18.
19.	IMP. TAX CREDITS	78,492	3,920	4,316	4,322	4,330	4,745	5,063	5,253	5,516	5,792	6,081	\$27,709	19.
20.	ITC-UTILIZED	0	0	0	0	54,816	45,240	5,063	5,253	5,516	5,792	6,081		20.
21.	NET INCOME.....	00	(\$367,318)	(\$221,825)	(\$100,531)	\$54,816	\$180,040	\$291,374	\$480,314	\$532,114	\$691,609	\$874,879		21.

STUDY SUBJECT.....		LOW COST NON-MSA												
STUDY DATE.....		06/24/88												
PREPARED BY.....		DLI												
EQUIPMENT SUPPLIER.....		LOW COST DOMESTIC SUPPLIER												
REV 06/94														
LINE NO.	DESCRIPTION	CONSTR. YR.	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL	LINE NO.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
FINANCIAL STATISTICS-														
1.	RETURN ON EQUITY.....	0.0%	0.0%	0.0%	0.0%	0.0%	533.0%	98.6%	78.3%	93.2%	131.1%	203.6%		1.
2.	RETURN ON INVESTMENT..	0.0%	0.0%	0.0%	0.0%	11.2%	19.3%	26.0%	31.6%	38.0%	45.6%	54.6%		2.
ADJUSTED INCOME TAXES														
3.		9.0	0.0	0.0	0.0	2.3	5.9	10.2	16.2	26.6	47.5	97.2		3.
CASH FROM OPERATIONS-														
4.	NET INCOME.....	00	(1367,318)	(1221,825)	(1100,531)	854,816	1180,566	8291,374	9400,314	6332,116	6691,409	8076,879		4.
5.	ADD DEPRECIATION.....	0	107,150	112,507	118,133	124,039	130,241	136,753	143,291	150,771	158,304	164,225		5.
6.	ADD AMORTIZATION.....	0	3,603	3,603	3,603	3,603	3,603	3,603	3,603	3,603	3,603	3,603		6.
7.	ADD ITC UTILIZED.....	0	0	0	0	54,816	45,248	5,903	5,253	5,516	5,792	6,901		7.
8.	NET CASH FROM OPS....	00	(1256,566)	(1105,715)	(982,400)	823,273	1339,132	8436,733	9532,761	6492,004	6859,113	81,052,700		8.
9.	LESS: INDEBT PAYMENTS..	(01)	(0)	(101,956)	(106,436)	(111,100)	(116,079)	(121,265)	(126,711)	(132,429)	(138,477)	(140,301)		9.
10.	DIVIDENDS.....	0	0	0	0	0	0	0	(315,997)	(354,059)	(416,843)	(1,000,405)		10.
11.	NET OPER. CASH FLOW...	00	(1256,566)	(1207,671)	(1088,536)	823,273	1339,132	8436,733	9532,761	6492,004	6859,113	81,052,700		11.
ACCUMULATIVE CASH FROM OPERATIONS.....														
12.		00	(1256,566)	(2464,236)	(3544,767)	(2721,494)	(1382,362)	823,273	1339,132	6492,004	6859,113	81,052,700		12.
NET CASH FLOW AFTER DEBT & DIVIDENDS-														
13.	EQUITY	(1075,793)	(1227,673)	(1229,623)	(1010,281)	8101,931	8217,660	8380,704	8370,932	6530,156	6791,746	9982,053	9381,147	13.
14.	TOTAL INV	(101,045,344)	(10308,838)	(10168,596)	(836,421)	8176,766	8295,619	8370,024	8482,717	8618,937	8781,009	8971,783	8370,496	14.
INTERNAL RATE OF RETURN														
15.	EQUITY												10.120%	15.
16.	TOTAL INV												14.169%	16.

FIG. 7 The financial statistics and cash flow for cellular radio in rural areas.

divides it by each year's wireline cellular demand shown on line 10 of Figure 3.

Figure 4 develops the cellular plant construction costs for 17 different plant categories, which are shown in column (B). In columns (C) through (I) the construction costs are shown for each of the seven sample non-MSA, or rural, markets. An average cost of construction by plant category is shown in column (K). All figures reflect third year subscriber demand levels and what TDS believes would be the cumulative plant construction costs through the third year for each rural cellular area. The dollar amounts shown in columns (C) through (I), except for land, digital carrier, vehicles, office equipment and contingencies, are based on actual preliminary price quotes TDS has received from equipment suppliers for these markets. For this discussion TDS has chosen the lowest quotes supplied by domestic manufacturers. The costs for other non-

quoted preliminary plant categories are based upon the best estimates available at this time. On line 17, TDS has added an additional 10% of the total of all costs on lines 1 through 16 to cover miscellaneous items and contingencies.

The total estimated three-year construction cost for each market is shown on line 18. The total plant cost ranges widely between markets from \$665,000 to \$1,372,000. The average cost for these seven rural cellular areas is \$968,000, as reflected in column (K). Line 19 again shows the number of proposed cells for each market as planned by our consulting engineers. Line 20 of Figure 4 shows the total cellular plant investment per cell; this calculation is simply line 18 divided by line 19.

Line 21 of Figure 4 calculates the cellular investment per cell excluding the switching equipment; this is another useful measurement.

Figure 5 permits the operating costs of the non-MSA cellular system

for the first 2 years of operations to be estimated and summarizes the total capitalized costs of the system. The first item that must be addressed when looking at operating costs is payroll costs. Decisions must be made regarding number of employees, job classifications, pay levels and payroll overheads. The assumptions for a non-MSA market are outlined in columns (C) through (E) on lines 1 through 10. In this market, it is assumed that there will be a need for four employees: first, a technical manager, who also would serve as the general manager, since this is a relatively small market; second, a secretary or clerk; third, a sales manager whose salary would be paid in part on a commission basis; and, fourth an administrative support person. On line 9, 10% has been added to payroll costs to be certain all such costs are covered. This conservative approach—over-estimating expenses and under-estimating revenues—is

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used throughout the model.

The other operating costs are shown on lines 11-19 in Figure 5. Line 11 reflects the recurring costs to the cellular operator of leasing the land-lines from the local telephone company to connect the cell sites to the mobile telephone switching office (MTSO) and to connect the MTSO to the telephone company switch. This cost averages approximately \$16,400 per cell, but the figure can vary significantly. One way of avoiding this payment to the local telephone company is by installing microwave equipment to handle the cellular traffic between the cell sites and the MTSO. Line 12 is used to reflect the cost of cell site rental, if applicable. It is assumed that land for cell sites is purchased rather than leased. Line 13 shows the costs associated with providing heat, air conditioning and electricity at each cell site. This cost is assumed to be approximately \$2000 per cell site. Line 14 is an estimate of the cost of office space rental for the main cellular operating office, including heating, air conditioning and electricity.

Lines 15 through 17 of Figure 5 show estimates of the advertising and sales expense for the construction year and the first two years of operation. In this model, the assumption is based on a specific level of advertising and sales costs per customer. In the first 2 years this cost is \$250 per customer and in the second year of operations, it is \$200 per customer, as it is through year 10. Line 18 is an additional 20% of the other operating costs to reflect any miscellaneous expenses not included in lines 11 to 17.

Line 19 is the annual depreciation expense. This depreciation expense has been calculated based on an estimated life of 10 years. Where it is financially feasible to do so, TDS would consider depreciating the cellular investment over a shorter, 8 year period. The annual costs as reflected in column (E) then are adjusted, using columns (F) through (H) which show the number of months these costs are anticipated to be incurred in the construction year and in operating years 1 and 2. For example, the technical manager (line 3) would be employed from day 1; thus, column (F), line 3 shows 12 months of expense in year 1. Likewise, TDS would anticipate the telephone circuit costs (line 11) would begin to occur at about the same time as the delivery of the cell site equipment at about the seventh month of operation; and thus, 5 months expense are built into year 1. Columns

(I) through (K) thus are calculated by taking column (E) times the appropriate fraction of a year derived from the months shown in columns (F) through (H).

The total annual estimated operating costs are shown on line 22 of Figure 5. Line 23 shows that the construction years pre-operating costs will be capitalized. The operating costs for operating years 1 and 2 as shown on line 24 will be totally expensed. Line 25 calculates the interest that will be capitalized during the pre-operating period; that is, during the construction year. Lines 26 through 28 provide a summary of the costs that would be capitalized and depreciated over the service life of the cellular investment. The three components of the capitalized costs are construction costs, operating costs (deferred construction costs) and interest during construction. Lines 30 and 31 show the year 1, or the first full operational year, cash out-of-pocket operating costs. These costs exclude depreciation expense since it is a non-cash charge. Line 32 of Figure 5 then calculates the total financial requirement for which the cellular applicant must show financing ability, in order to make a filing with the FCC for this Non-MSA market. This total is simply the total capitalized costs plus the first full operational year's out-of-pocket operating costs.

Figure 6 takes the data developed and calculated on prior exhibits and presents it in an operating statement format. This allows TDS to determine the financial feasibility of cellular radio in rural areas. Line 1 shows that an income tax rate of 50% for all 10 years has been assumed. Line 2 reflects the growth in expenses due to inflation. Line 3 shows the cost to the cellular operator per customer per year for what is called customer services. These services include such items as computer billing, data processing and accounting services. Many of these items can be contracted to outside suppliers. Line 4 is taken from exhibit 8, which is not included in this article. Line 5 is computed from Line 3 of Figure 6. Lines 5 to 11 are developed from Figure 5. Line 12 totals operating costs excluding depreciation. Lines 13 through 14 of Figure 6 show depreciation and amortization expense. Line 15 shows net operating income before income taxes. In this example, an operating profit is reached in year 4; excluding depreciation expense, there would be an operating profit in year 3. Line 16

shows the interest cost for each year. The interest cost is computed by taking the average debt outstanding during the year times the assumed interest rate of 13.5%. Line 17 shows taxable income. The first year of taxable income is in year 4, which is the fourth year of operation and the fifth year after the purchase order is issued. Lines 18 through 20 show income tax expense and income tax credits. Line 21 shows net income after tax; it is positive in year 4.

Line 1 of Figure 7 shows return on average equity capital for the year. Return percentages in early years can be misleading because equity declines rapidly, goes negative to 3 years and then builds back up rapidly. Line 2 shows return on total capital invested. This return figure is computed in a utility fashion since it does not add back income taxes. Line 3 gives the times interest earned ratio. Lines 4 through 8 compute the net cash available from operations after interest expense and taxes.

Lines 9 and 10 of Figure 7 deduct estimated repayments of principal on the debt and estimated dividends on the equity to arrive at net operating cash flow. These assumptions can easily be changed to repay debt principal more quickly, to avoid cash build up in the cellular operation and so on. Cash depletion and build up are reflected in line 12 (cumulative cash from operations). Line 13 shows the net equity input required and the net equity paid out to shareholders for each year. In the first 2 years the model assumes that cash shortfalls from operations (line 8) and 40% of new plant additions are financed through added equity inputs. Line 14 shows the net investment (debt and equity required for the project) for each year. Line 15 shows the internal rate of return on equity dollars invested in the project. This is a compound cumulative return on equity figure for the first 10 years of the project assuming the system is worth only book value at the end of the tenth year and it could be worth many times this figure. This rate of return can be compared to the return available from alternative non-cellular investment projects. Line 16 shows the internal rate of return on total dollars (debt and equity) invested in the project.

Based on the model results TDS has concluded that cellular appears feasible in the average non-MSA market. Feasibility in any particular market will depend on the specific demand—cost characteristics of that market. □

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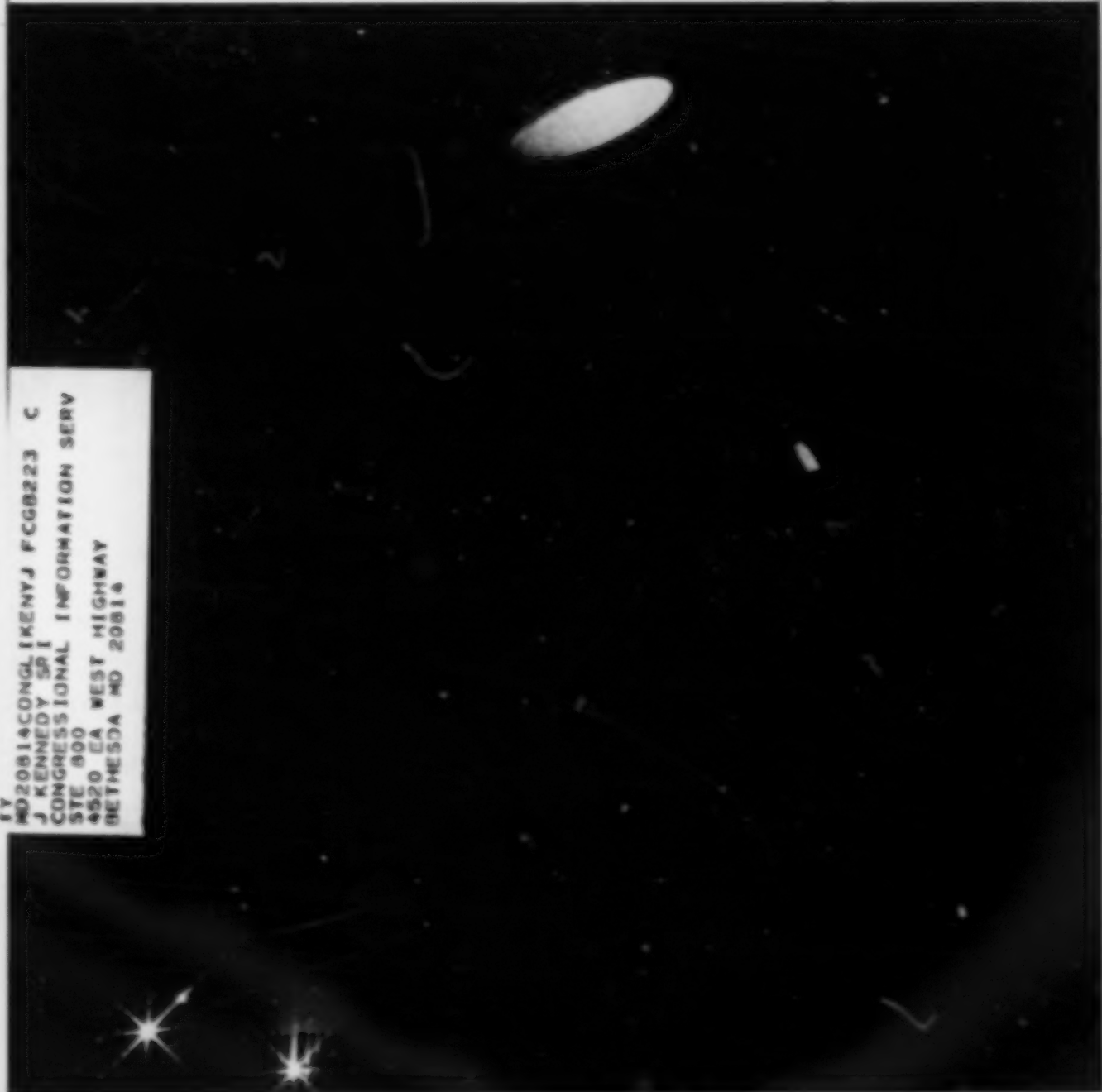
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The post-divestiture toll markets: a look at the shape and size

KENNETH R. DUNMORE

THE BREAK-UP of the Bell System has brought with it a change in the concept and structure of toll markets.

Prior to January 1984, the Bell operating companies (BOCs), Independent telephone companies and AT&T Long Lines together provided an integrated toll network of intrastate and interstate message toll services, (MTS), wide area telecommunications services (WATS) and private line services. With divestiture, this partnership has been dissolved. Pieces of the toll market now are distributed among the three partnership groups.

The modified final judgment (MFJ) in the American Telephone & Telegraph Co. (AT&T) antitrust case required the delineation of local access and transport areas (LATA) within which BOCs would be allowed to provide exchange, exchange access and toll services. Each state in which a BOC provided service, and there are 47 of them, was configured into one or more LATAs, with the exception of Delaware, which was in its entirety attached to the Philadelphia LATA. Independents were given the option of association with a BOC LATA for the purpose of providing joint services or forming an independent market area.

Intra-LATA services were made the nonexclusive domain of the BOCs. Inter-LATA services were

delegated to interexchange carriers (IXCs), such as AT&T Communications (ATTC), MCI, GTE Sprint and the other alternate carriers. Service between LATAs in different states may be provided on a competitive basis as a result of various Federal Communications Commission (FCC) and court decisions.

Service between LATAs in the same state is the domain of ATTC, at a minimum. It is up to individual state regulatory agencies to decide on the merits of competition for inter-LATA services within the states. Similarly, although intra-LATA services are to be provided by the BOCs and Independents, state commissions also may permit competition in this market.

For the most part, LATA boundaries stay within state lines. In order to provide continuity of service, ex-

ceptions exist which cause LATA boundaries to cross state lines. These exceptions account for an incidental number of telephones and telephone traffic, with the exception of Delaware. Another exception to the general rules governing LATA boundaries is the provision of inter-LATA corridor traffic by BOCs, which are generally forbidden from serving inter-LATA traffic demands. Due to the high cost of network reconfiguration, the traffic in certain corridors which cross LATA boundaries was assigned to the BOCs. These exceptions include New York City to northern New Jersey and Philadelphia to southern New Jersey corridors.

Figure 1 presents a pair of hypothetical states to illustrate the nature of the intra-LATA and inter-LATA

Continued on page 74

Table 1
MTS messages and distribution
(000,000)

	Intrastate	Interstate
Intra-LATA	799.6 (47.3%)	28.1 (1.7%)
Inter-LATA	296.4 (17.5%)	567.3 (33.5%)

Kenneth R. Dunmore is an Economist at Dale N. Hatfield Associates, Boulder, Colo.

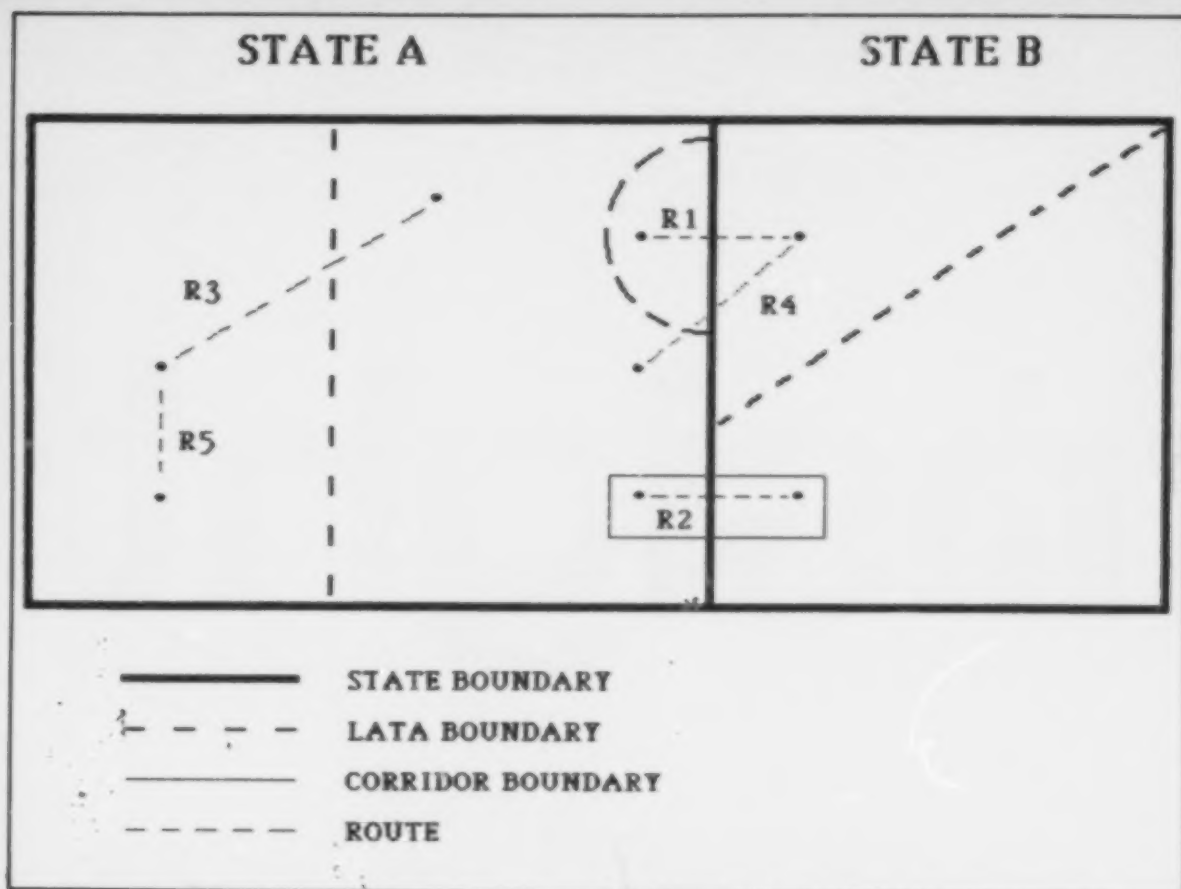


FIG. 1A pair of hypothetical states which illustrate the nature of the intra-LATA and inter-LATA markets.

markets. Route R1 is an intra-LATA, interstate route, a stateline exception. Traffic along R1, which previously had been carried by members of the Bell System, now will be carried by a BOC. Route R2 is an inter-LATA, interstate corridor exception which is also served by the BOC. Route R3 is an inter-LATA, intrastate route, the first non-exception, and would be served by ATTC and any other IXC which the state regulatory commission may certify. Route R4 is an inter-LATA, interstate route, which is the territory of the IXCs. Route R5 is an intra-LATA, intrastate route, which would be served, at least initially, by a BOC.

Regulation

There are still two regulatory jurisdictions as there were before divestiture. Now, however, the job of regulation is a bit more complicated; unless the regulatory authority deregulates as the Virginia commission recently did on intrastate, inter-LATA services. For the state regulators in particular, life has grown increasingly difficult. In a multiple LATA state, of which there are 39, the state commission must regulate at

least two toll service providers; decide if additional competition, either [intra-LATA or inter-LATA] is warranted; and oversee the intrastate access charge structure.

In many multiple LATA states, the regulatory commission has decided to allow inter-LATA competition. Many state commissions are considering also permitting intra-LATA competition; in general, however, the commissions have rejected it. With the opening of the inter-LATA markets to competition and the continued resistance to competition in the intra-LATA markets, it is worthwhile to see what the stakes are in these markets.

Data on inter-LATA and intra-

LATA markets are scarce, but there are enough to determine the size of each submarket relative to the total. Table 1, which is derived from a December 1983 Bell System monthly report, contains estimated message data for the MTS services provided by the old Bell-Independent partnership in December 1983.

Perhaps the most surprising aspect of the data is that the largest submarket is served by the BOCs. In fact, the MTS market that the BOCs can serve totals 48.7% of the total market. Since, in most states, intra-LATA competition still is now allowed, virtually half of the MTS market, as measured in message traffic,

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Table 2
Total toll revenues and distribution (\$000,000)

	Intrastate	Interstate
Intra-LATA	\$1976.3 (16.0%)	\$ 155.9 (1.3%)
Inter-LATA	\$2624.0* (21.3%)	\$7570.3 (61.4%)

*Estimated

remains regulated as a monopoly.

Message data, however, cannot tell the whole story. In terms of revenues, intra-LATA services make up a much smaller part of the market. This difference, for the most part is due to the shorter lengths of intra-LATA traffic. Shorter calls have two distinguishing characteristics: shorter call durations and lower per minute rates.

Table 2 contains first quarter 1984 toll revenues by geographic sub-market covering MTS, WATS and private line services reported by the BOCs and ATTC; the table was derived from BOC and ATTC quarterly reports.

The difference between the two sets of data is startling. Although the BOCs are allowed to serve nearly 50% of the message traffic, this traffic translates to a revenue share of only 17.3%, if interstate corridor traffic is not included. While this market segment totals more than \$2 billion in revenue, it is a much smaller share than is indicated by the message data.

Corridor markets

Corridor traffic tends to be high density and short haul in nature. With rates based on average cost, corridor

traffic should be highly profitable since its density will imply low costs per unit of traffic. The two corridors run between states and, as a consequence, their traffic and revenues are subsumed in the interstate, inter-LATA traffic reported earlier.

Due to the sharing arrangements between the BOCs providing interstate corridor services, it is not possible to precisely distinguish between the traffic and revenues of individual corridors. Interstate toll revenues for the three BOCs providing services in New York, New Jersey and Pennsylvania are estimated at \$88.5 million for the first quarter of 1984, or 1.1% of the U.S. interstate toll market (the interstate, intra-LATA revenues of Bell of Pennsylvania however, have netted out of the total).

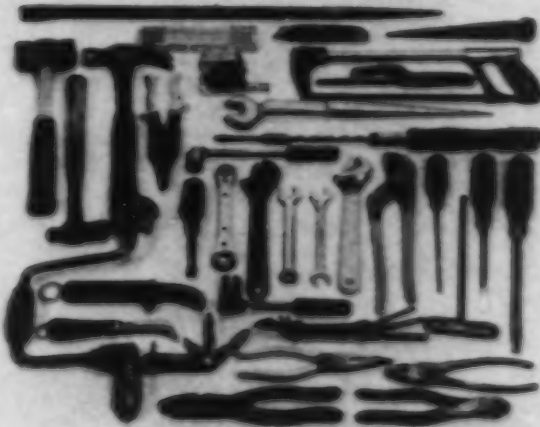
Implications

For the BOCs, the development of LATAs means restricted involvement in toll markets. Adding to this restriction from the FCC's Second Computer Inquiry and other requirements of the MFJ, future growth will be determined by the BOCs' ability to expand local and exchange access services. For AT&T, the market in terms of traffic and revenues is con-

siderably larger as a result of divestiture than the previous market served by AT&T Long Lines to interstate and intrastate, inter-LATA services. AT&T's success in the intrastate markets will depend on its ability to keep competitors out and maintain its desired rates. Since both questions will be decided by state regulatory commissions, which are tough adversaries in most of the major states, the prognosis is not overly optimistic. Even so, in the high growth states in the South and Southwest, the regulatory climate is not considered very severe. Much of AT&T's growth at the intrastate level is likely to come in these states.

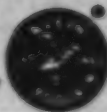
The other common carriers stand to gain the most from the formation of the new toll markets. With the BOCs more or less isolated from intrastate, inter-LATA markets, except for the provision of exchange access services, state commissions will be more receptive to certifying new carriers for inter-LATA service. Since these carriers have traditionally focused only on heavy route, interstate markets, the accessible market for them has effectively increased by 33% in terms of revenues and more than 30% in terms of traffic. □

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Before bypassing, beware!

ANTHONY BADALATO

BYPASS has received increased attention during the past several months and rightly so.

Spiraling telecommunications costs, lengthy installation intervals, uninspiring service levels and other industry developments have converged to fuel a growing telecommunications market segment.

Although many companies have installed or are contemplating bypass solutions for their communications networks, users should carefully consider several important issues before pulling the plug on the local telephone company.

Factors contributing

Bypass, as the term is used today, simply means the circumvention of the local telco's exchange network to move information to other locations in the same metropolitan area. While the concept and technical feasibility of bypass are not new, the technological springboard for the recent development of bypass was the introduction by Xerox Corp. of Digital Electronic Message Service (DEMs) in the early 1970s.

Xerox's plan was to accommodate a corporation's growing need to move information within a city and to provide access to long distance, or intercity services through very high capacity, high frequency microwave

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'...companies in a number of fields will continue to find new and intricate ways to use telecommunications to gain an edge on the competition. Although telecommunications may not be the primary focus of a company, it has become a key ...function that can no longer be ignored.'

transmission facilities.

If the idea has been around for so long, why is there so much hysteria now?

Although the reasons for increased interest in bypass differ on a case-by-case basis, there are three major issues involved:

- Lack of options at the metropolitan networking level.
- Growing importance of telecommunications to business.
- Consumer dissatisfaction with existing systems.

Options

Communications networks generally can be topographically segregated into three levels: intrabuilding, metropolitan and long haul. Only recently have options at the metropolitan networking level responded to customer demands and expanding options at the intrabuilding and long haul levels.

The metropolitan (across-town) connection, on the other hand, has become a bottleneck.

Primarily due to a combination of satellites, fiber optics and value added networks (VANs), long distance communication facilities have been in abundant supply for the past decade.

Satellites. With nearly 20 domestic satellites now operating and another 110 scheduled to be launched by the year 2000, a transponder glut is not difficult to envision. In addition, the increased sophistication and power of satellites and the diminishing size and cost of earth stations contribute to the increased viability and declining cost of satellite communications.

VANs. VANs continue to grow, both in terms of their number and of features offered. Tymnet and GTE Telenet, two of the longstanding sup-

Continued on page 92

pliers, have been joined by new competitors, IBM and AT&T. Additionally, a plethora of features, such as sophisticated billing packages and protocol conversion combined with end-to-end error free transmission, will work to enhance the popularity and reach of these services.

Fiber optics. Optical fiber technology also has contributed to the wide array of long haul options. Communications carriers such as AT&T Communications, MCI Telecommunications and ITT Communications have constructed high capacity, long haul fiber networks. Southern New England Telephone (SNET) and United Telecom are committed to building large fiber optic networks to serve as alternatives to existing long-haul options. Other companies have formed consortiums to build nationwide networks that will offer transmission capacity to common carriers. For example, Southern Pacific Transportation, Atchison Topeka Santa Fe Railroad and Norfolk Southern are planning to build a system called Fiber Track that will stretch from coast to coast.

Traditionally, intra-building communications involved point-to-point wiring from host computers to data terminals and private branch exchanges (PBXs) to telephones. Although easy to accomplish, the method is generally wasteful and unorganized. Local area networks (LANs) offered by PBX, broadband and baseband vendors have enhanced intra-building connectivity to the point where user terminal moves and changes do not require cabling and moving information at megabit speeds is possible.

CO bottleneck

Faced with the growing capacities and options at the intrabuilding and long haul network levels and their increasing appetites for communications capacity, users were becoming frustrated with relatively pedestrian network options at the metropolitan level. It was difficult to match the capacity and sophistication of intrabuilding and long haul services with options available for the middle, metropolitan link. Users had to rely on facilities built predominantly to support voice communications. Thus, bypass options have been emerging. And, although teleos recently began offering high capacity, digital alternatives for metropolitan network connections, they remain expensive, difficult to obtain and are subject to lengthy installation intervals.

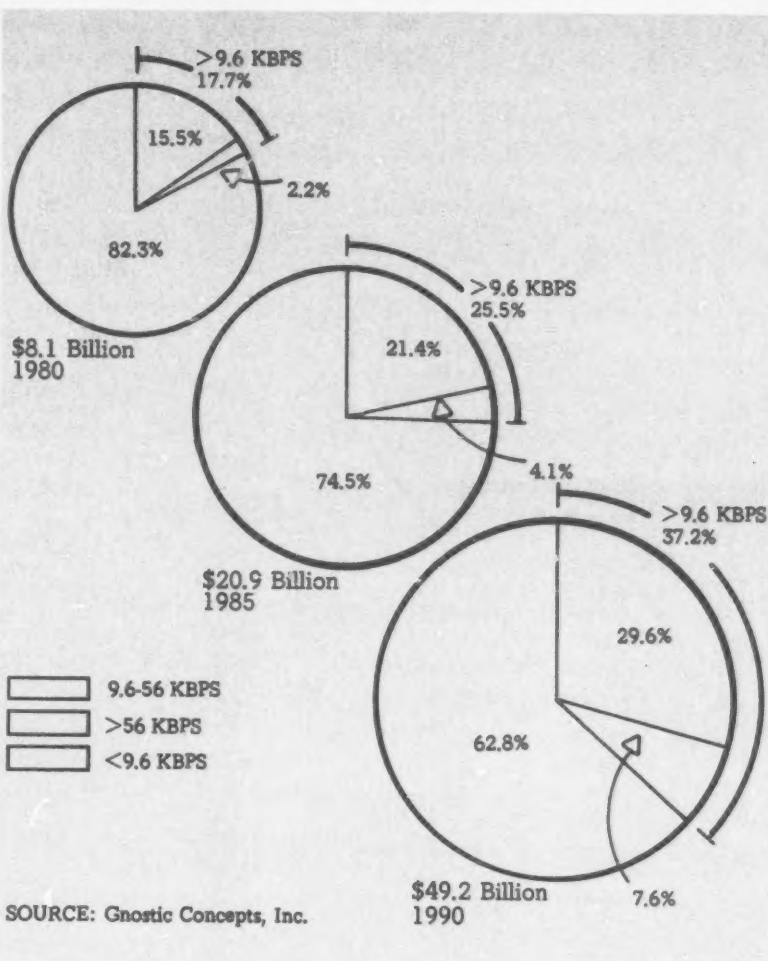


FIG. 1 An illustration of the revenues expected to increase in high speed local services.

Telecommunications plays an increasingly significant role in business today. For example, to remain competitive in retail banking, not only is it necessary to have attractive interest rates and competitive loan policies, but consumers also have come to enjoy the relative ease and convenience of automated teller machines (ATMs) which rely heavily on telecommunications services. The stakes appear to have increased again with the introduction of such at-home banking services as Chemical Bank's Pronto.

However, the battleground is not only in the banking industry and the broader financial services industry. Other sectors already profoundly involved include:

- Mobile cellular telephone, a technology still in its infancy, is being installed in Hertz and Avis rental cars in Chicago. Industry executives feel that the option of a mobile cellular telephone in a rental car may become as important as an air conditioner in attracting and retaining customers.

- Real estate developers are becoming increasingly interested in smart or communications-enhanced buildings. Smart buildings, a relatively new phenomena, offer prospective tenants the options of using (sharing) a building telecommunications infrastructure instead of purchasing and operating their own on an individual basis. Some of the services available in smart buildings include shared telephone systems, bypass microwave facilities and intrabuilding data communications. Real estate developers such as Olympia & York, Lincoln Properties and Tishman Realty recognize the value of constructing smart buildings to attract and retain tenants, and perhaps to generate incremental revenue and profits.

Clearly, companies in a number of fields will continue to find new and intricate ways to use telecommunications to gain an edge on the competition. Although telecommunications may not be the primary focus of a

Continued on page 94

company, it has become a key support function that can no longer be ignored.

There are companies in New York City and elsewhere waiting 12 months and longer for high speed, high capacity T1 circuits from local telephone companies. Who can afford to wait a year in these turbulent times? At the same time, demand for high speed services above kilobits per second (kb/s) has increased. Gnostic Concepts projects at an average compound annual growth rate of more than 22% (Figure 1).

Bypass provides an option that many companies in New York City have been quick to adopt. For instance:

- Citibank has installed a fiber optic network under Manhattan to connect its midtown headquarters with offices in three downtown locations. The company also uses microwave transmission to handle interoffice calls within Manhattan.

- Morgan Guaranty, another New York financial institution, also uses microwave links to connect buildings in lower Manhattan. In addition, it relies on a Manhattan Cable TV-constructed private broadband network between two of its locations for added capacity and redundancy.

- And, irony of ironies, both AT&T Information Systems and Nynex recently submitted bids to a large financial institution in Manhattan for the construction of a high capacity, fiber optic network that would bypass the embedded local exchange network.

- Izod Ltd., a subsidiary of General Mills, has turned to Local Area Telecommunications, a New York City company that moves voice and data over local microwave facilities, to communicate information between two buildings just five blocks apart. Local Area Telecommunications' edge is its rapid installation time, which can be as short as a week. Alternatively, many companies are using Manhattan Cable TV's public network, which offers data communications speeds between 1.2 kb/s and 1.544 megabits per second.

- New York City's Teleport project represents another major bypass development, although still years away from completion. Merrill Lynch, Western Union and the Port Authority of New York and New Jersey have teamed up to build the \$225 million office park and communications center. Located on Staten Island, Teleport will offer

users direct access to 12 or more satellites through an antenna farm at Teleport's Staten Island site. The Staten Island office and communications complex will be connected to business users in Manhattan and New Jersey by fiber optic cable, providing even more competition for the metropolitan communications market.

Bypass options are multiplying while interest continues to grow. Users want to quickly satisfy their appetite for communications capacity and flexibility with the kinds of service options available to them at the less regulated, more competitive long distance and on-site network levels. Users want to control the financial and technological evolution of their networks, a goal which bypass can help them attain.

Although many of the larger and more experienced companies are using bypass, a recent poll taken by

working using bypass as a consideration. In this case, the bypass alternatives were simply not feasible for many reasons, some of which were:

- Private network construction charges were extraordinarily high.

- Direct line of sight for microwave use was obstructed. The use of additional repeaters would be expensive, due to the high cost of renting space atop buildings, and increase exposure to network failure.

- Other intracity communications carriers were more expensive or offered less capacity than the eventual supplier, New York Telephone.

In many cases such as this, local telcos, aware of competitive pressures, have multiplied their options and adjusted their rates. Many of the Bell operating companies (BOCs) have filed or plan to file tariffs to offer end user, high capacity T1 facilities. Also, many telcos plan to replace

'Bypass. . . simply means the circumvention of the local telco's exchange network to move information to other locations in the same metropolitan area.'

the International Communications Assn. (ICA) of its members, which are mainly large corporations, reveals that there may be more smoke than fire. Gauged to assess the extent and dangers of bypass to the local telco offices, the survey showed "there is no bypass problem that endangers carriers or universal services, either now or in the foreseeable future." The survey also indicates that customer bypass is perhaps a "less significant factor in the overall telecommunications industry than previously asserted."

Some 29% of the ICA members surveyed now use some type of bypass facility. About 60% said that the use of bypass facilities would not provide an adequate option for most users at most locations. About 66% of those considering bypass have not yet reached a decision requiring major economic commitments. A recent example lends support to the findings of the ICA study.

One decision

A major New York financial institution, along with Coopers & Lybrand, recently studied ways to enhance its New York City interbuilding net-

aged facilities with fiber optics. In addition, BOCs are rapidly installing digital central office switching; projections suggest that 90% of local and metropolitan transmission lines will handle digital traffic by 1990.

Considerations

There are clearly real opportunities available with bypass solutions. However, there are potential pitfalls that should be examined thoroughly before altering a company's networking course. They include:

Staffing. Does the organization have enough qualified people to understand and support the new network approach? For example, the technology of a broadband-based network is altogether different from that of an analog network.

Vendor. Has the vendor ever done this before? What type of back-up support can it provide? Does it have a solid reputation in the industry? Many vendors, realizing the opportunities available, are expanding their horizons into providing bypass services. However, sometimes the maintenance and support facilities, such as on-site maintenance, and network

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The breakup of AT&T: one Independent's view

MICHAEL B. ESSTMAN

THE FEDERAL government greeted the new year on Jan. 1, 1984, by dismantling the Bell System, the organization that served as the backbone of the national telephone network.

Since then the average American has come to realize something. The telephone network is not ordinary. Divestiture has shown the public there is more to telephone service than just that unassuming device that sits on their table-tops and adorns their walls.

People are beginning to understand two things. The telephone network may be unassuming, but it is as valuable as oil in the ground. Second, by breaking up the Bell System, much more has happened than just settling an antitrust suit.

The decision to divest the Bell System is the culmination of a trend that began in the 1950s and has now brought the access era. Divestiture lies on a plan where several disciplines intersect: communications, economics, law, social science, politics.

What has divestiture meant to the Independent industry?

This article will discuss what has actually happened this year to one company, Continental Telecom, from the standpoint of three items: mechanics, revenue, operations.

Contel's Eastern Region mirrors many Independent operations. It is made up of large and small companies that operate in rural and urban surroundings in 13 states.

The world of long distance service has been rearranged: from who provides it, to who is responsible for the costs and how those costs are recovered. It is a multi-billion dollar

conversion for a multi-billion dollar business.

The industry had perfected a tidy system to deal with long distance revenues before divestiture: separations and settlements. There were four basic steps: First, traffic studies were made. Each year roughly 33% of telco exchanges were tested for usage. Local calling and the amount of intrastate and interstate toll calling were tested. From these tests traffic factors were developed. Using these factors, telcos divided investment and expenses into three categories: local, intrastate toll and interstate toll. This separation resulted in step two of the process, a cost study. The bottom line of the study, of course, represented the toll revenue requirement. Telcos did this once a year.

In step three, the cost studies were then filed for review and approval with the Bell operating company (BOC) with whom the Independent connected. Step four is the settlement itself. The Independent sent the BOC all the toll revenues that were billed and collected, and the BOC paid the Independent the settlement. That settlement was recorded as toll revenue on the Independent's income statements, and it was based on the BOC's achieved rate of return.

The toll revenue requirement the Independent received was based on traffic volumes, the investment and expenses that the Independent assigned to toll in its cost studies and the BOC's achieved rate of return. In turn, the BOC would reflect the settlements as an operating expense. The BOC used that level of expense to set toll rates. All the toll revenue that was billed and collected was reflected as revenue on the BOC's books.

Lots of paperwork and labor were involved, but this system served the industry and the country well for decades. The settlements process made the national telephone network second to none and achieved the univer-

sal service goals set by the Communications Act of 1934.

Since divestiture, this world has not only been rearranged, it has been fired up to a new orbit. The industry has been given its marching orders: less regulation and more competition. Accordingly, instead of settlements, the industry has been rocketed into an access charge arrangement. Telcos still do traffic studies and cost studies. But that is where the similarity ends—and even that is not quite the same.

First, telcos are responsible for tariffs that spell out all the access and related services provided toll carriers, along with the price of each. Telcos also must bill the carriers on a monthly basis, and collect access revenue on a monthly basis.

For 1984, Contel has joined the National Exchange Carrier Assn. (NECA) to carry out the procedure. Through NECA, Contel follows industry-wide access charge tariffs and pools access charge revenue with the other members.

Obviously the number of players in the long distance market has increased considerably. Instead of sending one cost study to one carrier once a year, Contel is billing AT&T every month and still settling with the BOCs. And the company is dealing with a new entity, NECA. If and when Contel decides to develop its own interstate access tariffs, then the Federal Communications Commission (FCC) also will become a participant.

But, of course, this is only half the picture. The access arrangement just described concerns only interstate toll traffic. How the intrastate toll revenue requirement is recovered depends on the specific access plan for each state.

Local access and transport areas (LATAs) are intended to mark off the BOCs' domain for long distance within each state. But from a pro-

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Michael B. Esstman is Vice President-Eastern Region for Continental Telecom, Inc., Atlanta. This article has been adapted with permission from a presentation made Sept. 13 in Atlanta at the Fourth Annual University of Georgia Public Utilities Conference.

cedural standpoint, LATAs actually create states within states. At last count there were 161 LATAs. Traffic between each must be handled by AT&T or some other toll carrier. Contel, therefore, must charge for access services using tariffs approved by the state regulatory bodies.

Some states pool this access charge revenue. Others generally use a so-called bill-and-keep method. Still others are combinations of the two, depending on whether the traffic stays inside one LATA or crosses into another. There are 10 states in Contel's Eastern Region that require access charge tariffs, and there are four distinct state plans.

To summarize, the old system required Contel to deal only with the BOC to recover its toll revenue requirement. To accomplish the same thing under divestiture, Contel is working with NECA, the BOCs, AT&T and its competitors, various state plans, and, eventually, it will work with the FCC. And more than 60% of Contel's revenue came from toll revenue.

What about the revenue itself? What effect have divestiture and access charges had on the company's toll revenue streams?

Contel joined NECA in 1984. The company's revenue to a large extent depends on NECA's achieved rate of return. In May, the FCC authorized a set of access charges that, together with volume forecasts, were designed to produce the returns for NECA members shown in Table 1. Based on the same access charges, but different volumes, NECA forecast the returns shown in Table 2. The preliminary, unofficial returns for June, July and August based on data submitted to NECA by its members are shown in Table 3.

As Table 3 clearly shows, there are some serious deficiencies. In Contel's Eastern Region, a 1% change in rate of return is roughly equal to about \$4 million in revenue.

It is impossible to specify a single determinant for the deficiency: the problem is too complex. But the deficiency generally is related to usage. Most of this year's revenues are based on projections of investment and expenses along with usage. At this stage, it is becoming obvious that the actual minutes of usage are less than had been projected.

Furthermore, it appears the drop in AT&T's long distance rates had not resulted in the expected increase in calling volumes. When AT&T was ordered to cut its rates by 6.1% every-

Table 1
FCC forecast

Non-traffic sensitive: 11.0%
Traffic sensitive: 13.3%
Billing and collection: 12.75%

Table 2
NECA forecast

Non-traffic sensitive: 8.4%
Traffic sensitive: 11.1%
Billing and collection: 12.75%

Table 3
Actual returns

	June	July	August
Non-traffic sensitive:	8.42%	9.79%	9.99%
Traffic sensitive:	9.36%	10.16%	11.51%
Billing and collection:	(-0.8%)	1.09%	1.37%

one assumed that calling volumes would increase. In fact, calling volumes were expected to go up by 13.5%. But the demand has gone up barely half of the anticipated amount; the expected calling volumes just have not materialized.

As expected, the returns for intra-LATA toll are below historic intrastate levels. This was expected because of the nature of the short haul toll business: Short haul toll is less profitable than long haul toll. The divestiture left AT&T with the longer routes, while the BOCs generally have the shorter haul, higher cost toll business.

The interLATA portion is much more complex. In some states, Contel is doing very well, while in others the returns are less than satisfactory. The level of returns is related to two factors: the cost of providing that service and the fact that the interLATA tariffs in most of the company's states mirror the NECA tariff.

NECA rates are based on nationally averaged costs. But the costs in individual states can be above or below the national average. Therefore, where the cost of providing service is above the national average, the returns are deficient, and where the cost is below the national average the returns are good. Both conditions prevail in Contel's Eastern region.

Many states are now working to develop their own specific plans for interLATA toll; bill-and-keep is where most of them seem to be headed. But this tendency points once again to the need for correctly forecasting usage.

Figuring out how much the network is used seems like something a telco could deal with handily. But it is

not so easy. The problem is rooted deeper than first imagined.

Consider, for instance, what a minute-of-use means to the telco and what it means to customers. There is a difference. There are seven components to a telephone call: off-hook, the end office dials the digits, customer acknowledgement, switching, answer supervision, the conversation and disconnect.

As far as customers are concerned, the minutes-of-use are in the actual conversation time. But the minutes-of-use the telco recognizes with access at the customer acknowledgement component. Access begins much earlier than the conversation: after the customer finishes dialing and the call switches through our network. Actually, access is provided even if the customer gets no answer or finds the line is busy.

Obviously, telcos need to perfect capturing and calculating how much the network is used. The distinction between a conversation minute and an access minute is one example of the problem. Measuring terminating usage is another. In the future all access tariffs will be based on forecasted access volumes in addition to investment and expenses. This goes for interstate and intrastate traffic.

When telcos reach that stage, there will not be a chance to backtrack a year later, file a cost study, and correct estimates or allocations. Any revenue shortfall will be lost forever. There is much more revenue opportunity under this system, but it is also much riskier than the settlements system. What telcos bill is what telcos will get!

This point is critical. The opportunity
Continued on page 100

tunities everyone in the industry believes are open will not materialize unless telcos can account for every minute of access. In fact, that will be telcos' business in the future: selling access to subscribers and carriers.

The industry has always placed a lot of emphasis on accurately forecasting investments and expenses. It now needs to place the same emphasis on usage.

End users

The discussion thus far has focused on access charges as they apply to toll carriers. But there is the other, more politically volatile side of this phenomenon: access charges for subscribers or end users.

Many people have strongly opposed the very concept of customers paying interstate access charges. One school of thought claims the charges will erode universal service. Others contend the charges are just plain unfair, that a flat rate fee is improper, even if customers originate or terminate interstate toll calls. Still others criticize the charges on jurisdictional grounds. By proposing end user charges, critics say the FCC has wrongly assumed *de facto* regulation of local rates.

The controversy over this issue has risen to the highest political levels. Everyone concerned has seen the evidence, as time and again the FCC has found it necessary to review its proposals. Right now the FCC is still at an impasse over even the most basic issues.

The debate on end user charges is counterproductive. The toll carriers currently are paying access charges for telcos' non-traffic sensitive plant. By 1990, however, those payments will cease and those carriers will only be responsible for funding a small pool to cover the so-called high cost telephone companies.

If this sounds familiar it is because the industry is still on a course leading straight toward Pure II, a situation which is inequitable. Subscribers and toll carriers are both users of the local network, and each should pay its fair share of the costs.

To its credit, the FCC at least recognizes the political difficulties and is open to suggestions.

The FCC's goal, of course, has been to develop a more equitable system of cost allocation, a system that is consistent with the deregulated, competitive environment the commission has encouraged. To that end, the long standing practice of allocating non-traffic sensitive costs to inter-

state toll must come to an end quickly. That system, according to the FCC, is just too arbitrary. The big culprit here is the subscriber plant factor. But whatever is changed, it must all be accomplished without sacrificing universal service or promoting uneconomic bypass.

Contel believes the best way to meet this goal is to gradually replace arbitrary methods with methods that are more factual; that is, to replace subscriber plant factor with something that can be based solely on usage.

This usage sensitive factor should be applied to allocate all non-traffic sensitive costs. This factor is identical to the subscriber line usage factor, but Contel calls it the exchange network usage factor, or ENUF.

Frankly, Contel believes that ENUF would be enough! Unlike the Pure II arrangement, carriers would pay a portion of telcos' non-traffic sensitive plant under that telcos' ENUF plan. But Contel's tests with the formula show the costs would still drop significantly. The costs would not drop down to zero as Pure II would have it, but they would be low enough to encourage competition and effectively counter the threat of bypass.

The result of such a move, of course, means some revenue requirement would be transferred to state jurisdiction. But that is exactly where Contel believes the responsibility should be.

Not everyone benefits equally from technology and competition—especially people who live in more sparsely populated regions. In those areas, the states and the local telcos should be able to assign costs and set rates that reflect the particular economic circumstances. With an access plan based on usage, this could be accomplished.

For example, the likelihood of bypass and the degree of universal service needs could be taken into consideration through combinations of local rates and carrier fees. This kind of system would provide flexibility. In addition, there are provisions within Contel's overall plan for limiting what would be transferred to state jurisdiction per year. The current high cost formula also would be maintained.

But, most importantly, ENUF precludes the political debate over interstate end user access charges. The FCC has said in the past that an end-user fee "is an equitable and economically sound method for recovering a

portion of non-traffic sensitive costs." But Contel believes that fee has always been an implicit part of the basic exchange rate. Right now at least, connection to the local network is the same as connection to the toll network. In practice, there cannot be one without the other.

Based on that principle, ENUF puts those costs right where they belong: under state jurisdiction. By using the ENUF formula, those non-traffic sensitive costs will be recovered through state rate adjustments. Therefore, there would be no need to go beyond the ENUF plan and levy an end user charge.

How has divestiture affected Contel's operations? The company's old Settlements Dept. in the Eastern Region has grown from a staff of 19 people to a staff of 33 people. And the department now is called Intercity Revenues Dept.

This growth is also reflected further down the line. Each of Contel's five divisions has set up Network Access Bureaus. These men and women serve as the company's link to toll carriers, state commissions and connecting companies.

Network planning is another area that has taken on a new role. Sooner or later, the existence of more than one toll carrier should stimulate use of the network in some areas. But where will Contel provide equal access? What network configuration would be best for each office that converts? Where will access tandem switches be needed? Right now Contel is studying many areas in anticipation of precisely these kinds of changes.

As far as traffic between LATAs, AT&T retained its operator services. AT&T wants that business on its switchboards. But intra-LATA traffic is another matter.

Independent companies may have the choice of staying in the business, or paying someone else to do it. Contel is looking at its operator centers very closely.

Finally, there are the telco's customers. They are seeing some prices go up, and they are hoping that some prices will come down. The jury is still out on that last point, but certainly there is more variety and choice available to customers now.

But there is also room for more confusion, so it is understandable that customers get perplexed from time to time. Getting a telephone installed or repaired is a little more complicated, and some people are

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Long haul transmission: a cost comparison

THE CONTINUING improvement of old technologies and the emergence of new methods have combined to produce a wealth of choice for long haul transmissions of voice, data and video.

While the choice may be constrained by physical factors, in many cases the critical items will include cost as a major factor.

A communications system designer has a tremendous variety of technologies from which to choose depending on the specifics of the desired system. The boundaries be-

tween the appropriate areas for these technologies are not sharp; in fact, a complete system will often use several of them. Table 1 shows some of these current technologies and gives a brief synopsis of their areas of best applicability.

This article concentrates on the long haul portion of the communications system, so some of the communications technologies listed in Table 1 are not examined in detail. These technologies will often be used for local distribution at the terminals of the long haul links. The three major technologies that this article is concerned with—geostationary satellites, terrestrial point-to-point microwave and optical fiber cable—have more or less defined areas of compe-

tence, depending on the length and density of the link, as well as other features. Remember, however, that the boundaries of these areas change with changes in technology and relative costs among the three techniques.

Satellite systems

Geostationary communications satellites have been providing domestic transmission services to the United States since 1974, and account for a growing share of the domestic long haul market. A typical C-band satellite transponder on a U.S. domestic spacecraft has a radio frequency (RF) bandwidth of 36 megahertz (MHz) and a radiated power of 34 decibels referred to 1 watt (dBW); this has been used as a standard reference in this article, although other bandwidths and higher power levels are being placed in service. Transponder capacity can be scaled by bandwidth, if adequate power is available. Scaling for power increases is more complex.

The use of a reference transponder provides a reasonable standard for comparison, since many carriers will continue to use 36 MHz or a multiple thereof, and power levels are not in-

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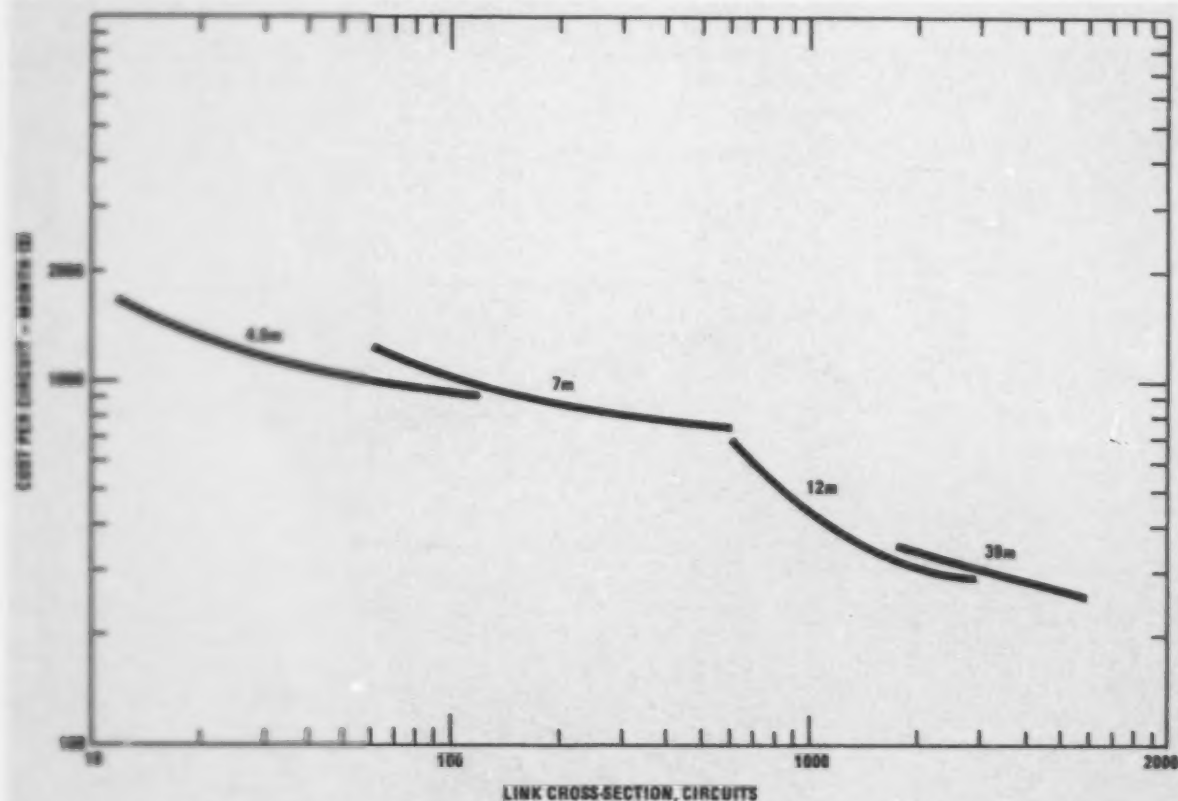


FIG. 1 Cost per circuit-month for companded FDM/FM satellite circuits.

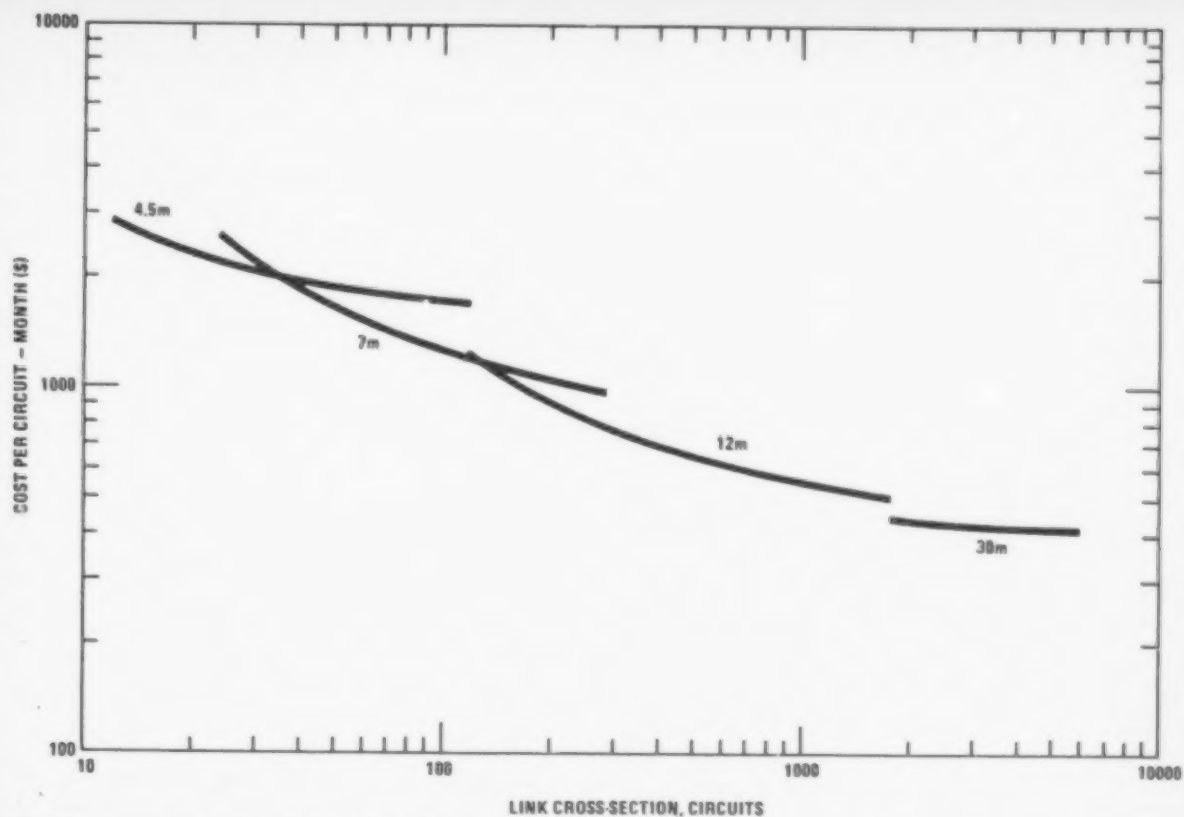


FIG. 2 Cost per circuit—month for satellite TDMA and TDM.

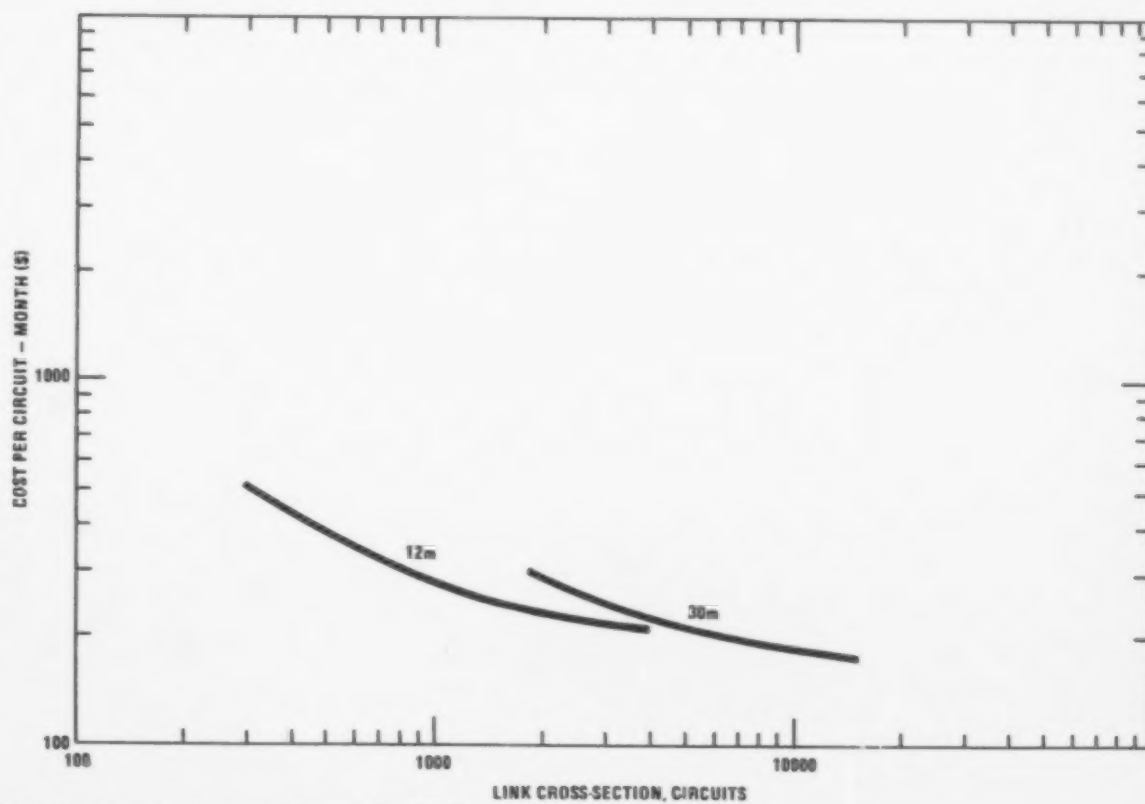


FIG. 3 Cost per circuit—month for satellite CSSB.

creasing rapidly, although they are changing.

Transmission costs have been developed for a range of earth station performance criteria and modulation/access methods.

The performance parameters of the earth stations used as examples are shown in Table 2. In many cases, larger earth stations are already in service in the United States, but the general trend until recently was toward the use of smaller antennas and less expensive station configurations.

Last year's decision by the Federal Communications Commission (FCC) to reduce spacing between satellites to 2° will curtail significantly the use of smaller antennas. A new antenna standard, 3 decibels (dB) more stringent than the previous standard, was also part of the decision. A 4.5 meter (m) or smaller antenna at C-band may very well be unable to meet the new criteria on a production basis. At Ku-band or 30/20 gigahertz (GHz) or Ka-band, small antennas will have no trouble meeting the standards.

Another concern which will affect the use of smaller stations is the recent flap about spectral efficiency. While such modulation schemes as companded single sideband (CSSB) do result in more efficient use of spectrum, they also require larger stations. Any undue emphasis on spectrum-efficient schemes tends to discriminate against the smaller station.

The general trend to smaller stations will continue because many users want and need them. Even uses which are quite spectrum-inefficient will be offered, taking advantage of the market which opens when a low cost facility is available.

The modulation/access methods used are:

- CSSB with either single or multiple access;
- Frequency modulation (FM) using frequency division multiplexing (FDM) and either single access (single carrier per transponder) or multiple access (multiple carriers per transponder); and
- Digital phase-shift keying (PSK) modulation, using either a single carrier per transponder/single access, or a single carrier per transponder/multiple access (TDMA) configuration.

For FDM/FM systems, an evaluation has been made for both companded and uncompanded signals; companding can significantly increase the number of channels per carrier. The digital systems were evaluated both with and without digital speech interpolation (DSI). Use of

Table 1
Communications technologies

Lowest Facility (wires or cable)	Easy of use, quickly available (sometimes not), little or no capital investment needed, growth and innovation.
Local area cable using cables (coax or fiber)	High data rates, short distances usually, can accumulate long haul traffic, mainly data oriented.
Local area microwave	Essentially similar to cable microwave but over longer areas.
Medium to long haul microwave	Very capital intensive, can provide very high capacity, proven technology, limited frequencies.
Satellite	Very capital intensive, high capacity possible, distance-independent, broadcast coverage, limited frequencies.
Optical Star	Extremely high capacity is possible, very capital intensive, infinite reuse of frequency, technology changing very rapidly.

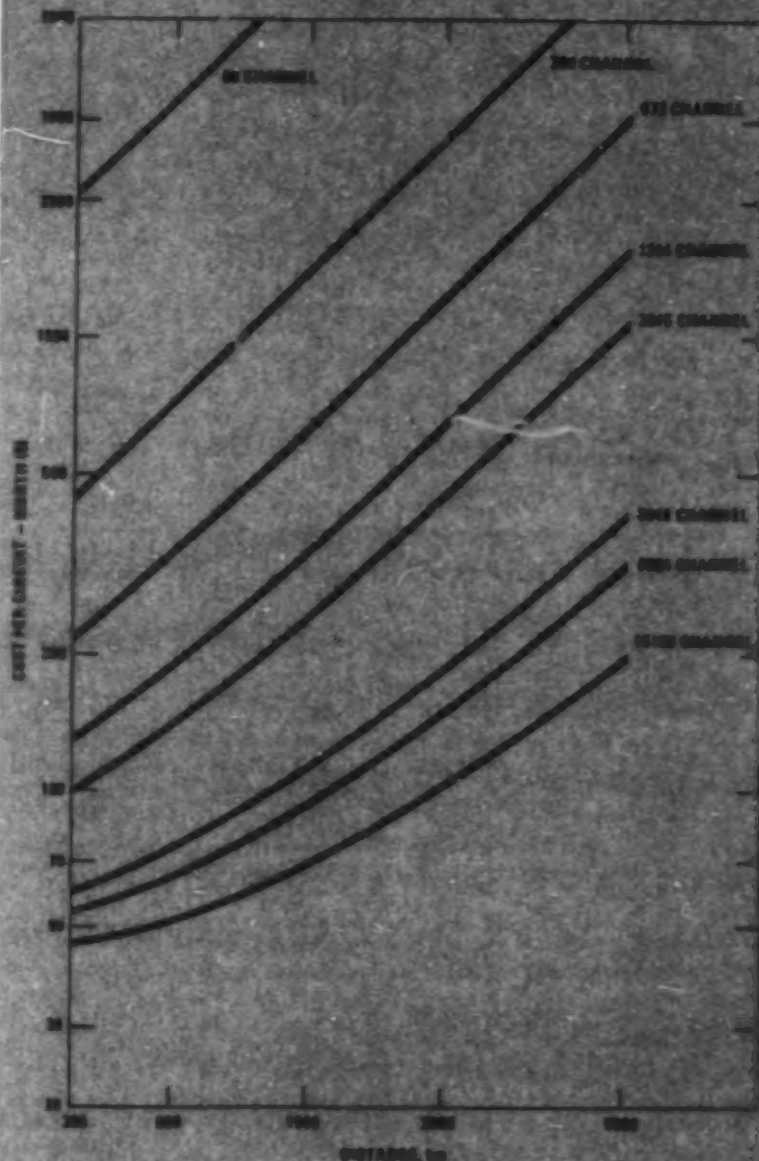


FIG. 4 Cost per circuit-month for optical fiber (excludes right of way)

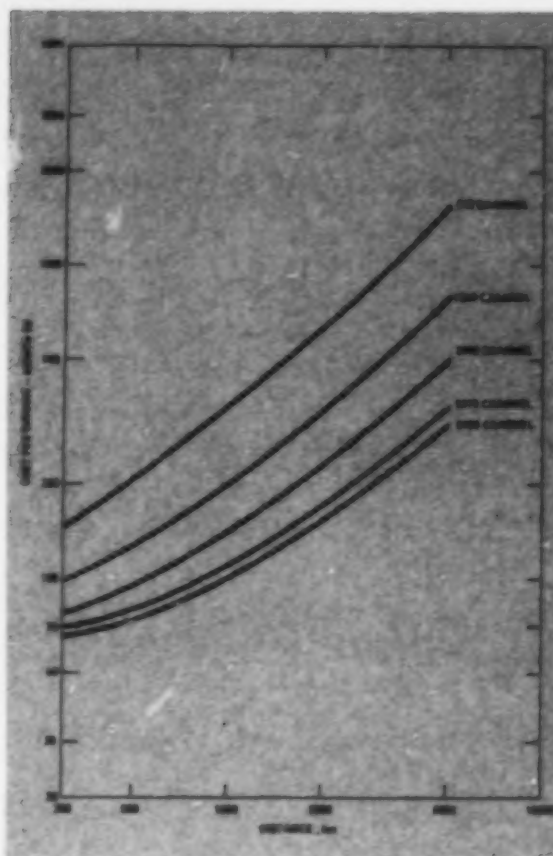


FIG. 5 Cost per circuit—month for 90 Mbit/s digital microwave radio.

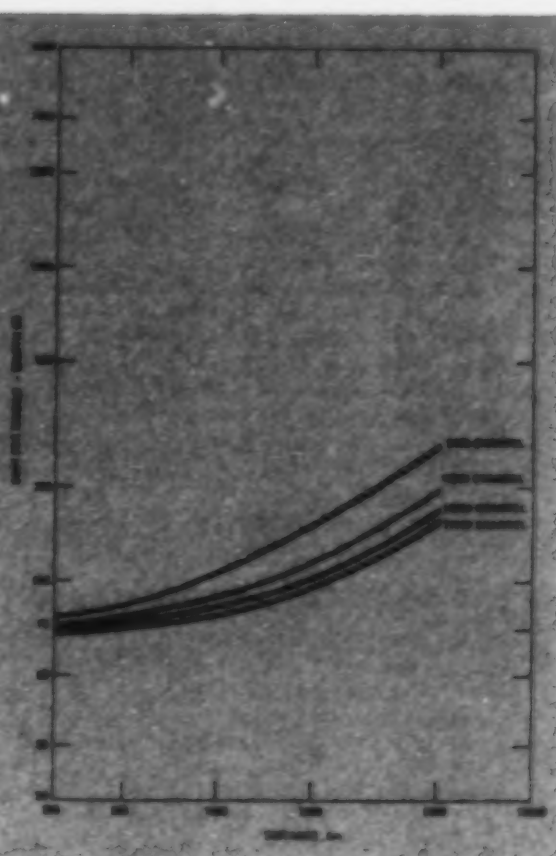


FIG. 6 Cost per circuit—month for SSB terrestrial microwave.

DSI can double the capacity of a carrier loaded primarily with voice traffic. Figure 1 shows the cost per circuit per month for companded FDM/FM satellite circuits; Figure 2 for satellite TDMA and TDM; Figure 3 for satellite CSSB.

Since, within the visibility of the satellite, costs are distance insensitive, the only variable is the number of channels carried by the earth station.

Optical fiber

During the past few years, optical fiber technology has developed from the point of experimental and trial installations to standard commercial offerings. Optical fiber offers five primary advantages:

Large bandwidth. Bandwidth is the information carrying capacity of the transmission medium. Fiber optic bandwidth is specified as a function of distance. The typical bandwidth in graded-index fibers ranges from 400 MHz per kilometer (km) to 1000 MHz/km. A 0.25 in. diameter cable containing two optical waveguides can carry the same volume of communications as a 3 in. diameter com-

Table 2 Example earth station technical characteristics				
Antenna diameter (m)	4.5	7	12	30
LNA temperature (°K)	100	100	40	40
G/T (dB/K)	21	25	34	42
Transmit gain (dB)	48	51	55	62

munications cable containing 20,000 copper wires.

Small size, low weight cable. Optical fiber is quite compact for a high bandwidth system. Optical fibers are mere strands; the core diameter can range from 250 micrometers to 5 micrometers for the single-mode fiber. The size advantage is augmented by a weight advantage. After it is fully cabled for protection, the waveguide often weighs less than 25 kilograms/km.

Low loss. Laboratory results have yielded signal attenuation as low as 0.2 dB/km in single-mode silica fibers. The attenuation is dependent on both the fiber type and the wavelength of the light source. Older optical fiber systems transmitted in the short wavelength range, of 850

nanometers (nm), and featured losses on the order of a few decibels per kilometer. Systems are currently available which transmit the longer wavelengths, 1300 nm, and feature a lower loss, less than 1 dB/km. Attenuation will be reduced even further with future developments in the 1500 nm to 1600 nm band.

Noise immunity. Because the fiber waveguide is totally dielectric, it is immune to induced noise, whether in the form of electromagnetic interference, radio frequency interference or electromagnetic pulse.

Electrical isolation. Optical waveguides, because they transmit via photon emission, are immune to electromagnetic interference from lightning, power line noise, corona

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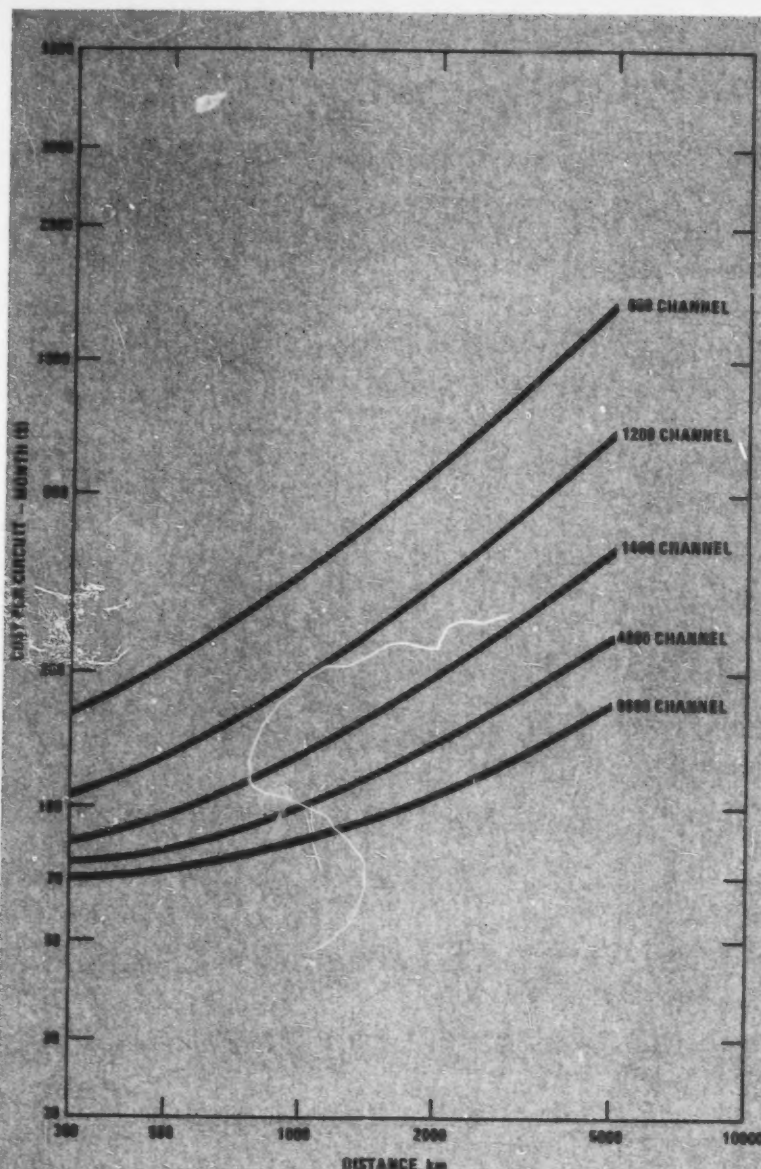


FIG. 7 Cost per circuit—month for FDM/FM terrestrial microwave.

Table 3

**Fiber optics costs per km
(1984 dollars)**

	Transmission rate (Mb/s)			
	180	405	575	1150
Number of fibers	4	4	4	6
Cable cost	2050	2050	2050	3075
Cable installation	10,000	10,000	10,000	10,000
Repeater (50 km spacing)	480	480	480	720
Total	\$12,530	\$12,530	\$12,530	\$13,795

The cost is based on a 100 km reference path; it does not include term. of electronics or MUX.

discharges and other interference sources. As a result, fiber cables can be used to transmit across high voltage potentials.

In addition to those advantages listed, fiber optic systems are resistant to intrusion and, therefore, can be used for secure transmission. Table 3 shows the installed optical fiber cost per kilometer. Figure 4 shows the calculated cost per channel as a function of distance and the cable capacity.

Costs for fiber systems will vary widely, since they are highly dependent on the cost of installation. The figures shown for installation costs are probably low in urban areas. Costs of over \$40,000 per mile are entirely possible in major cities. Because of this factor, there will be few, if any, fiber systems with moderate or low capacity. The trend will be to install a large number of fibers at once, even if little is used immediately.

Microwave radio

The most mature technology of those examined in this piece, radio relay systems, has been carrying long distance telephony since the late 1940s. While much existing equipment uses FDM/FM, there is a trend toward the use of digital radio in new and replacement systems. Figure 5 shows the cost per circuit per month for 90 megabits per second (Mb/s) digital microwave radio; Figure 6 for single sideband (SSB) terrestrial microwave; Figure 7 for FDM/FM terrestrial microwave.

In order to provide an informative cost comparison among the three transmission methods, the costs for variations in channel capacity on the link and connection distance of the link have been computed. The satellite case, of course, is invariant with distance. Figures 8, 9 and 10 present the comparison for distances of 100 km, 500 km and 3000 km, respectively. The relationship between microwave radio and optical fiber remains about the same through these variations, as would be expected since they are both terrestrial techniques. At the larger distances, the advantage of the satellite system can be discerned.

Figures 11, 12 and 13 show the comparison as a function of distance for capacities of 60, 600 and 6000 voice circuits per link, respectively. These figures illustrate the fact that satellite circuits are best for relatively long, lightly loaded links, and optical fiber

Continued on page 141

systems for shorter and heavier links, with microwave falling between them over a broad range.

Local distribution

Because of the limited data rates supportable within the voice-grade telephone plant for local distribution, and the need for alternative systems to interconnect automated business machines, several alternative local distribution systems have been developed. Some of these systems, primarily designed for service to automated business machines, use coaxial cable or optical fiber cables for limited distance, relatively low data rate connections.

More recent developments in low cost microwave, using packet system access techniques and the 10 GHz band, have resulted in a number of applications for construction being filed with the FCC. These digital termination systems (DTS) promise to furnish a relatively inexpensive interconnection for data users that can be employed for local communications or connection to satellite earth stations for long haul data transmission.

Other considerations

Other issues relating to transmission cost which concern potential users are the introduction of low cost earth stations and the use of multi-beam and hybrid satellites. These tech-

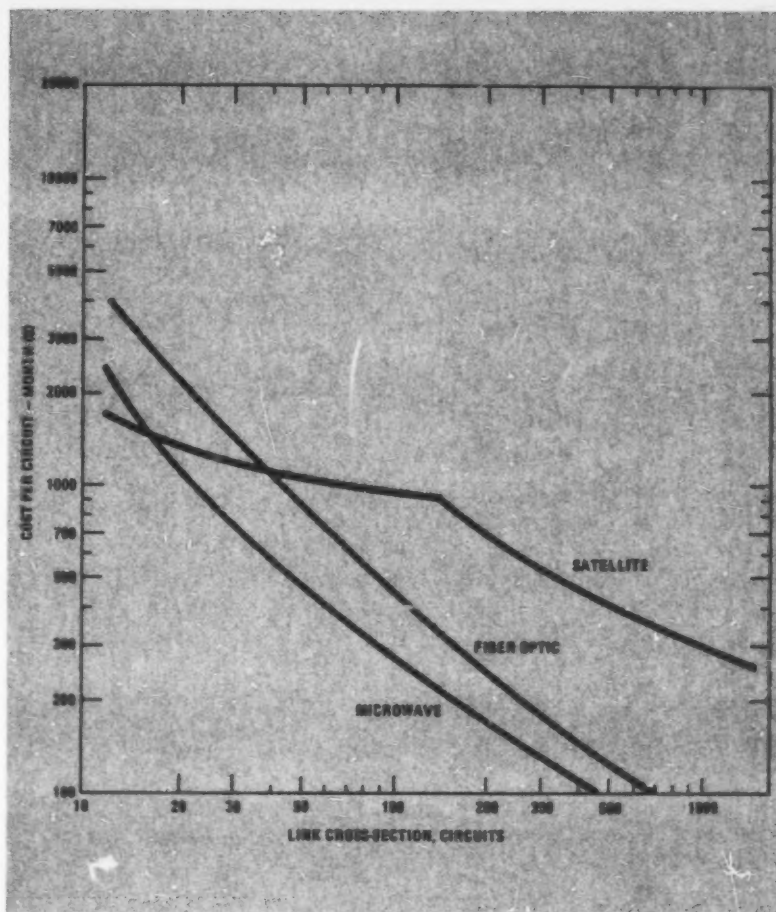


FIG. 8 Cost per circuit—month vs. link cross-section length = 100 km.

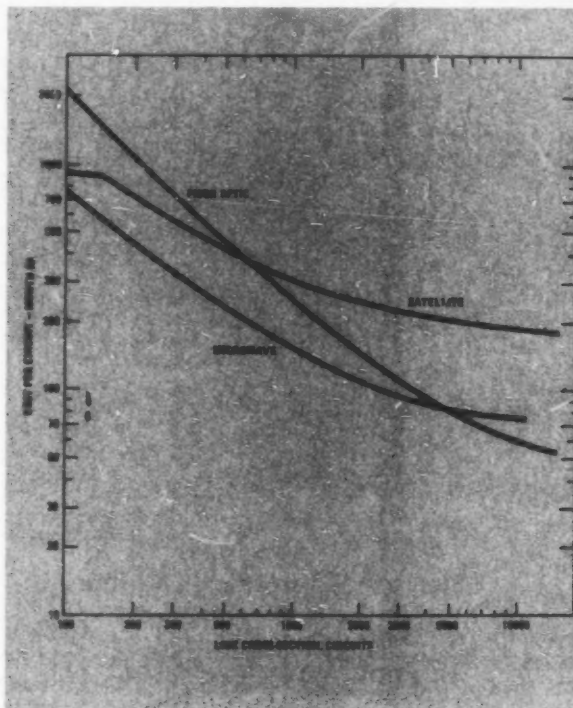


FIG. 9 Cost per circuit—month vs. link cross-section length = 500 km.

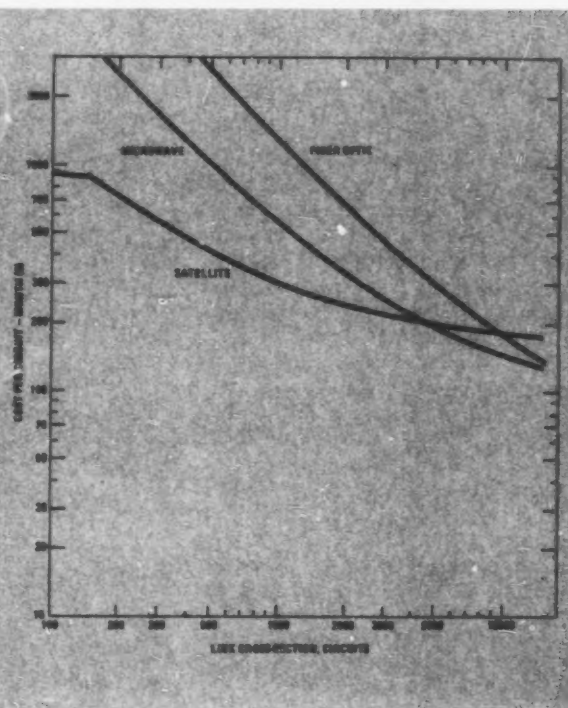


FIG. 10 Cost per circuit—month vs. link cross-section length = 3000 km.

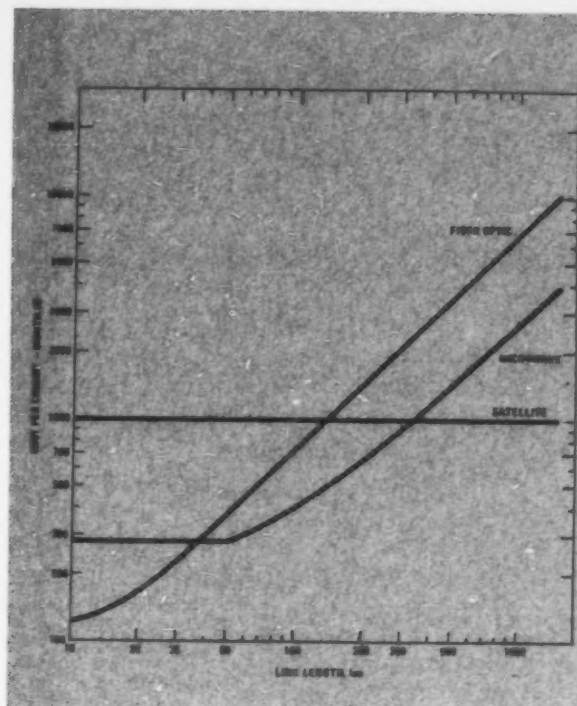


FIG. 11 Cost per circuit—month vs. link length cross-section = 60 circuits.

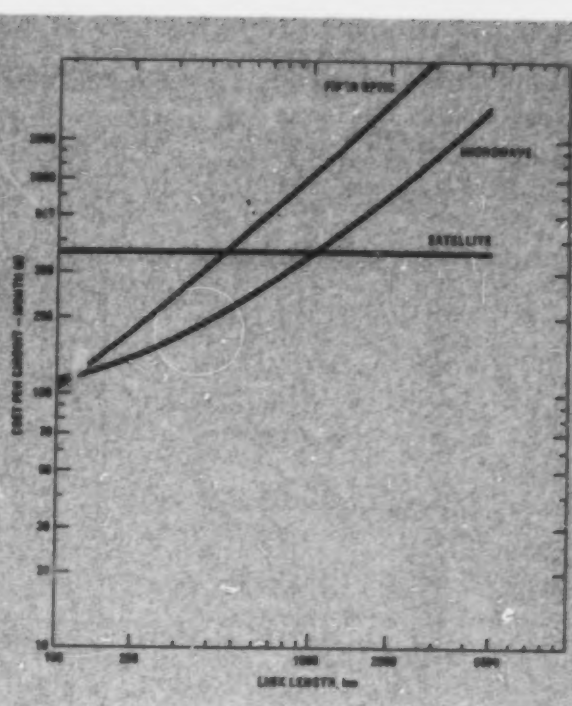


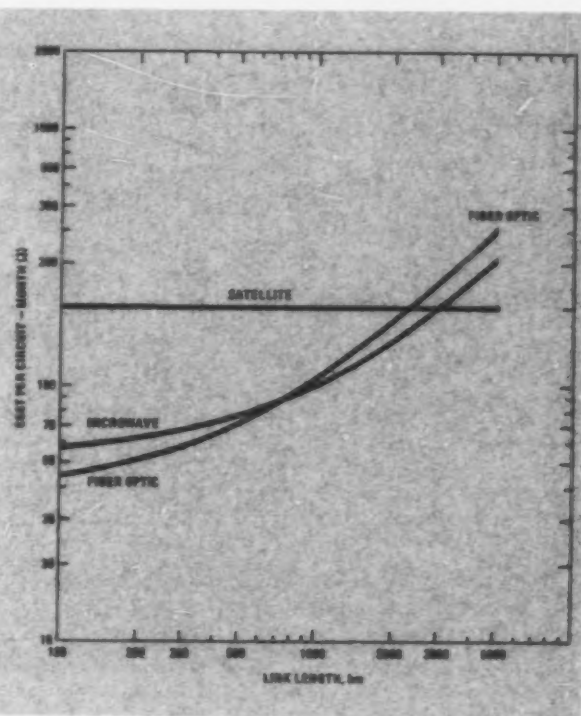
FIG. 12 Cost per circuit—month vs. link length cross-section = 600 circuits.

nologies promise to bring the cost of satellite communications to a lower level, both in the near term and toward the end of the century.

Low cost earth station technology is an offspring in part of the boom in television receive-only earth stations. This boom has resulted in the widespread manufacture of inexpensive antennas in the 4 m to 7 m range, and the development of low cost field effect transistor (FET) low-noise amplifiers. The increased interest in satellite communications among corporate users which has lately been in evidence also has spurred manufacturers to offer inexpensive earth stations for corporate communications networks. These stations use single channel per carrier or narrow band TDMA access methods to allow transponder costs to remain low, because only a small fraction of the capacity of a transponder is used, while still providing demand-assigned capacity for a flexible system.

Hybrid, or multiple frequency band, satellites have a number of advantages in network and otherwise. Each earth station potentially has access to all other earth stations, regardless of their frequency of operation, provided that the frequency bands are interconnected on the spacecraft. Network expansion is facilitated, since an earth station system may be augmented by a station

FIG. 13 Cost per circuit—month vs. link length cross-section = 6000 circuits.



operating in any of the bands. This can be of particular benefit in avoiding interference with the terrestrial microwave environment or in using lower frequencies in locations where rain attenuation is a problem.

One form of hybrid satellite which is particularly efficient, and which

may come into widespread operation in the late 1990s, is a large, multi-beam communications platform. Such a satellite combines the benefits of multiple frequency bands, multi-beam area coverage antennas and on-board switching to create a flexible and efficient facility. □



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management facilities lag behind a company's marketing and implementation efforts.

Back-up and redundancy. What happens if a cable break occurs under a street or microwave radios become misaligned atop a 40-story building? The organization should have a solid contingency plan that is tested often to ensure its reliability. Whether a least cost network is constructed that perhaps allows for somewhat degraded service or a specialized company is used, back-up plans are just as important as the primary network.

Business objectives. What will the company's information requirements be over the next few years? Does the network have the capacity and flexibility to grow and shift with the company's needs? Are some options too rigid or confining? The network should be capable of supporting projected as well as unexpected business demands.

Miscellaneous. Does the user have line of sight between locations? Will repeaters or reflectors be required? Are microwave frequencies available? What happens if a building is constructed in the midst of the company's microwave paths? Can the company use repeaters or reflectors to alleviate the problem? Will the landlord, if the building isn't owned by the company, permit the user to install microwave equipment? Are the environmental conditions right for the selected transmission media? The list goes on and on. However, these are the details that have to be checked to make the project work.

Costs. After a company has planned for all the contingencies outlined above, is the system still cost justified? Is the payback reasonable? Are there factors that override telecommunications-related costs? For example, the ability to expand the network quickly sometimes can mean the difference between acceptance and rejection of a new business venture.

There has been enormous progress in recent years in bypass technology, yet bypass is sometimes not as simple or feasible as a vendor's glossy literature often leads a potential user to believe. Competition and rising user interest have hastened the development and introduction of options by telephone companies.

Thus, when users begin to examine the options and all of the pitfalls of bypass seriously, the decision to pull the plug on the telephone company will not be an easy one. ☐

Continued from page 100

not completely sure what choices they have. But despite the screaming from the media, the situation is nothing near chaos. The newspapers and television commentators do not give the public enough credit for resourcefulness.

Donald Guinn, chairman of Pacific Telesis, made an excellent observation about the divestiture's effect on customers. "After all, these are the same people who've learned to use VCRs, automatic tellers and public transit systems," Guinn said. "Some have even learned how to fill out income tax forms and negotiate the freeways. Somehow I think we'll also learn how to order a telephone and get it fixed if it breaks."

Contel's advertising asks people to call the company with their questions. Even if a problem is not the company's responsibility, it will try and fix the problem or find a solution.

Contel is just one example in an industry that has turned itself inside out. A system designed to regulate franchised monopolies now faces the challenge of adjusting to a different set of circumstances. The question today is whether the traditional process is changing sufficiently to achieve an orderly transition to a competitive environment. The three basic truths about the American telephone industry, after all, have not changed. Universal service, affordability and reliability are as important as ever.

If any one of these three truths is threatened, the industry has a clear obligation to find ways to modernize and streamline the system so the public will enjoy the best of all worlds.

But moving beyond current controversies, everyone should remember that the industry's current environment has been brought on by its good fortune. The new technologies responsible for these changes are cutting the cost of sending messages and stimulating a much needed boost in telco productivity. Like the robot welders on auto assembly lines, competition and technology will benefit business and society as a whole, although maybe not each and every individual.

So far the industry is adjusting and so is Contel. The company has made its plans; in fact, all companies have made their separate plans. It looks like the industry may even know the rules.

But most importantly, the industry has committed itself to make it work. And it will. ☐

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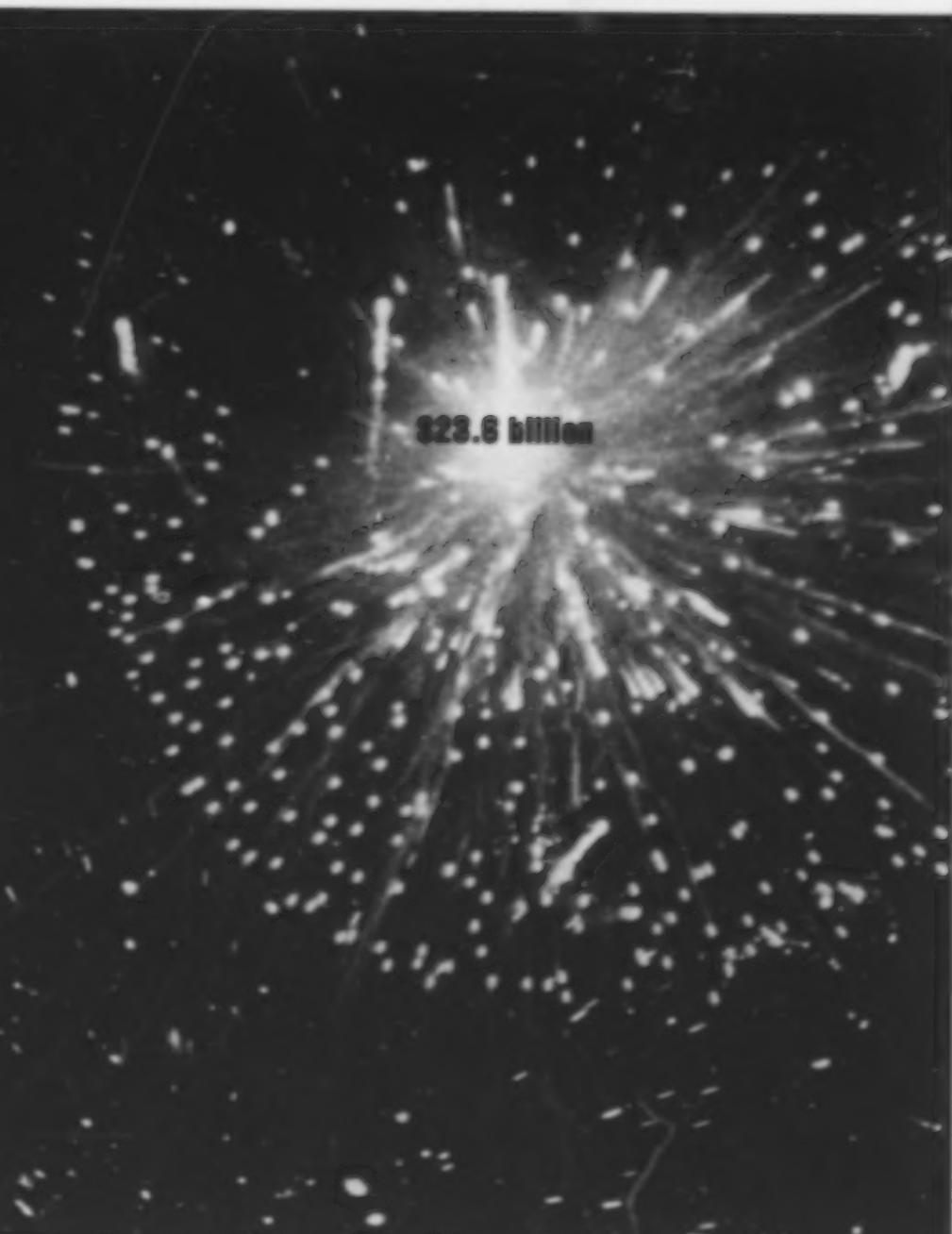
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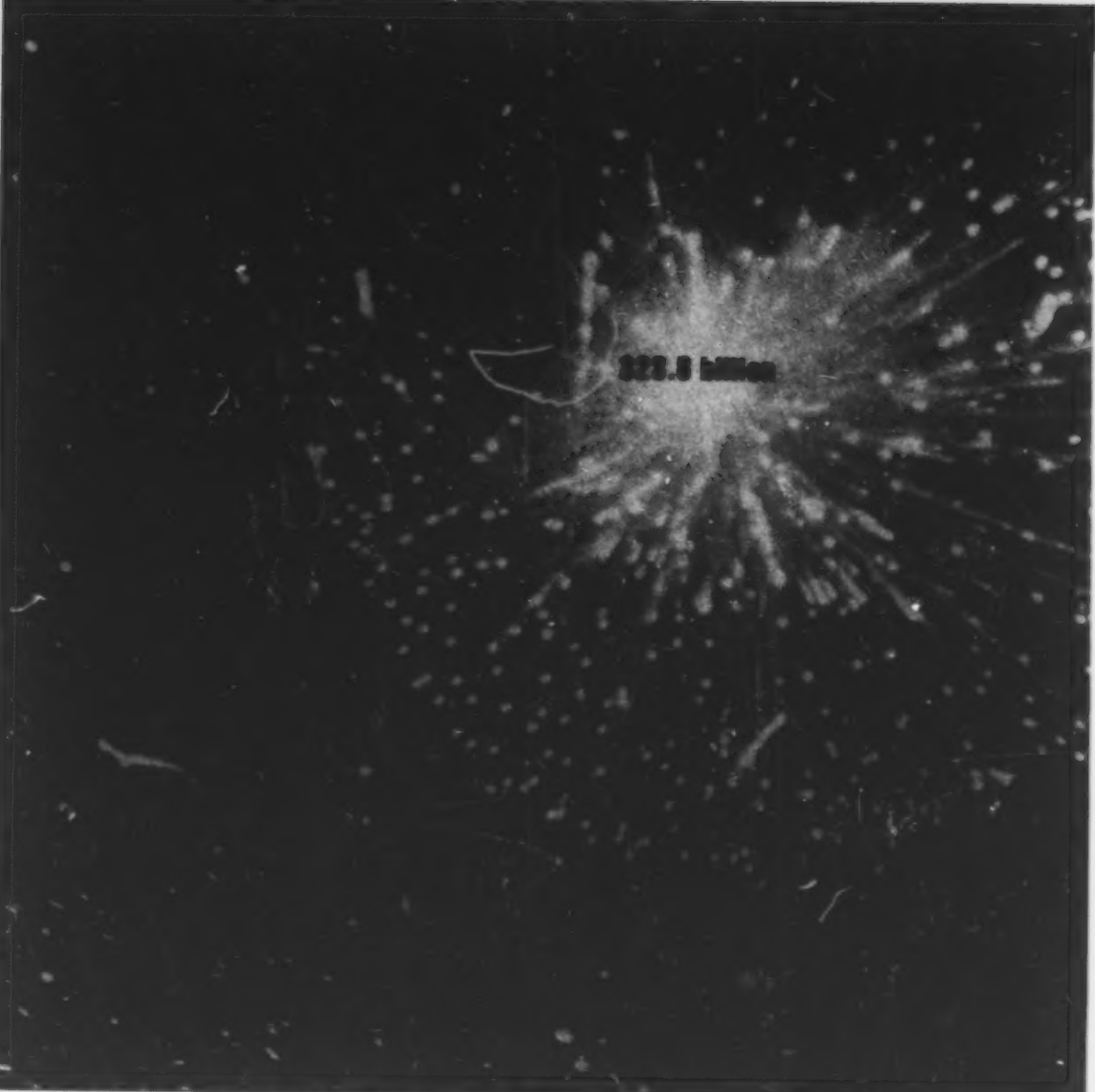
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\$23.6 billion

Cover photo by Del Myers

One year after the divestiture of AT&T, U.S. telecommunications carriers are planning to spend \$23.634 billion this year. It will be an extremely busy year.

Telecommunications carriers to spend **\$23.634 billion** in 1985

DEL MYERS, EDITOR, and
CZATDANA INAN, MARKET RESEARCH DIRECTOR

TELEPHONY/January 14, 1985

Table 1
U.S. carrier construction expenditures (\$000,000)

	RBOCs*	Independents	Interexchange Carriers	Total
1986	14,287	5,738	4,080	24,105
1985	14,177	5,439	4,018	23,634
1984	13,053	4,954	3,720	21,727
1983	12,506	5,128	2,600	20,234
1982	13,613	4,986	2,000	20,599
1981	13,502	5,091	1,700	20,293

* RBOCs 1981-1983 construction budgets are adjusted to reflect divestiture.

UNITED STATES telecommunications carriers are planning equipment and construction expenditures of \$23.634 billion in 1985, an increase of \$1.907 billion over their actual spending levels in 1984 (Table 1).

Of the forecast amount, the regional Bell operating companies (RBOCs) will spend \$14.177 billion; the Independents, \$5.439 billion and the interexchange carriers, \$4.018 billion.

Correlating the 1985 forecast with TELEPHONY's 1984 (Jan. 16, 1984, p. 34) forecast of \$30.82 billion "for a composite telecom industry" can be done easily: The 1984 forecast contained an estimate of \$8.155 billion for the voice and data communications customer premise equipment (CPE) market. Subtracting this amount from the 1984 forecast yields a figure of \$22.709 billion for comparison with the 1985 forecast of \$23.634 billion, which contains no estimates for CPE.

Correlating the 1985 forecast with those of the previous monopoly years is considerably more difficult but not less important. Therefore, making a correlation that provides a clearer picture of spending in the new environment required the following steps:

- Adjusting the RBOC budgets of 1981-1983 to correspond to deregulation and post-divestiture conditions.

- Including Southern New England Telephone Co. and Cincinnati Bell with the Independents and similarly adjusting Independent spending from 1981-1984 to reflect their presence in this group.

- Grouping together the interexchange carriers and adjusting their consolidated spending from 1981-1983 to correspond to the deregulation and post-divestiture condition of AT&T Communications, formerly AT&T Long Lines.

The adjustments shed considerable light on the 1981-1983 RBOC budgets which showed a spending decrease of 18% for the period—from \$16.8 billion in 1981 to an estimated \$13.7 billion at the end of 1983. Actual spending in 1983 was \$13 billion, reflecting an actual decrease of 23%. This decrease is, however, artificial, because it relates to a share of the budget for "customer movement" or customer premise responsibility, an area affected by deregulation.

Spending for customer movement fell from 20% of the 1981 budget to a mere 4% of the 1983 budget. Adjusting these amounts out of the 1981-1983 budgets to match post deregulation and divestiture conditions reveals that the total remaining spending for the period decreased only 7%. The adjusted spending levels for 1981-1983 respectively were \$13.5 billion, \$13.6 billion and \$12.5 billion (Table 2).

The RBOCs spend \$13.1 billion for equipment and construction during 1984, an amount that is 6% less than the forecast of \$13.9 billion but a real increase of 5% over the adjusted spending level of \$12.5 billion in 1983. As the RBOCs move to provide equal access and accomplish other priority objectives in 1985, spending will increase by 9% to \$14.177 billion.

Spending will stabilize at an estimated \$14.3 billion in 1986.

Southern New England Telephone Co. and Cincinnati Bell arbitrarily have been grouped with the local exchange telephone companies that are not affiliated with post-divestiture Bell regional holding companies (RHCs). The 1981-1984 forecasts and spending levels have been adjusted to reflect their inclusion with the Independents. Based on preliminary reports, the Independents spent \$4.954 billion in 1984, 12.8% less than the forecast of \$5.586 billion. In 1985, Independent spending is expected to increase to \$5.439 billion, still some \$147 million less than the 1984 forecast amount. In 1986, Independents expect to spend \$5.738 billion.

The interexchange carrier market bustled with action during 1984. The major carriers reportedly spent \$500 million in a bare-knuckles advertising campaign to obtain or retain customers. Equal access became available in a few locations, providing the first real test under near-equal conditions of customer preference for a long distance company. And several hundred resellers continued their role as long distance retailers.

This forecast, however, focuses on some two dozen major interexchange carriers who already have or are constructing and expanding their own facilities. In 1984, these interexchange carriers spent \$3.7 billion on digital switches, the expansion of existing microwave routes with single sideband technology, construction of new digital microwave routes, satellite fa-

Table 2
Construction budgets: 1981-1986 (\$000,000)

	1986	1985	1984	1983	1982	1981
RBOCs						
ANIRITECH	2041.4 ^a	2010.4 ^a	1735.3 ^a	1804.0	1755.3	2019.5
Illinois	660.0	650.0	496.6	376.8	535.5	650.4
Indiana	225.0 ^a	212.0 ^a	200.9 ^a	189.5	184.3	201.9
Michigan	479.6	487.3	422.3	388.8	438.7	512.9
Ohio	468.0 ^a	442.0 ^a	417.5 ^a	389.0	407.8	450.1
Wisconsin	209.0	219.1	198.2	180.1	188.0	204.2
BELL ATLANTIC	2057.0	1973.0	1783.0	1875.6	2094.3	2220.7
CA	893.0	876.0	757.0	804.4	882.4	928.5
New Jersey	588.0	548.0	509.0	537.9	610.9	697.2
Bell of PA	576.0	549.0	517.0	533.3	601.0	643.0
BELLSOUTH CORP.	2380.9 ^a	2530.0	2340.4	2270.0	2749.8	3046.4
South Central	1080.9	1027.9	976.9	970.2	1228.1	1270.8
Southern	1300.0	1502.1	1363.5	1299.8	1521.7	1765.6
NTWEX CORP.	1837.6	1852.3	1848.8	2043.6	2158.3	2163.9
New England				829.5	886.3	728.9
New York				1214.1	1252.0	1435.0
PACIFIC TELEVIS						
Pacific	2300.0 ^a	2156.3	1993.0	1821.0	2436.0	2757.0
SOUTHWESTERN BELL CORP.						
SW Bell	1930.0 ^a	1896.0	1780.0	1897.0	2294.6	2243.2
US WEST	1900.0 ^a	1821.1 ^a	1732.4	1965.7	2112.2	2380.7
Mountain				896.7	1172.9	1280.8
SW Bell				386.4	500.6	552.0
Pac NW				322.6	438.7	557.9
		Prior Divestiture Adjusted		12976.9 (471.2)	19400.5 (1987.22)	16047.4 (1345.4)
Historic Comparison TOTAL:	14286.7	14177.1	13053.1	12505.7	13615.3	15801.8
INDEPENDENTS						
QTE (Domestic)	2453.0	2365.0	2173.0	2099.0	2258.0	2327.0
United Telecom	578.1	594.5	537.0	486.0	525.5	580.0
Continental	449.1	470.9	474.3	463.3	430.5	407.3
Central Corp.	175.0 ^a	173.5	166.7	161.7	185.5	196.4
Altice Corp.	194.6	160.0	144.8	140.4	153.2	128.3
SUBTOTAL	3831.8	3763.9	3495.8	3310.5	3599.7	3637.3
Puerto Rico Tel	128.0	126.0	117.0	97.5	71.1	113.1
Rochester Tel	65.7	96.9	47.1	39.8	44.2	51.4
Century	41.7	41.3	37.3	41.9	54.4	28.6
Lincoln Telecom	23.0	34.3	30.9	31.2	35.4	37.0
TDS	26.0	29.5	28.5	31.0	26.1	24.5
SUBTOTAL	284.4	326.0	260.8	241.4	231.2	296.6
Commonwealth	28.0 ^a	27.0 ^a	24.0 ^a	20.0	14.1	12.5
Pacific Telecom	38.5	30.0	37.0	29.4	30.7	33.1
Anchorage Tel	29.8	36.2	40.3	30.1	38.1	22.4
Citizen Util.	32.0 ^a	30.5	27.1	24.6	30.5	34.9
Illinois Com.	13.9	17.4	13.4	11.4	22.8	26.0 ^a
SUBTOTAL	152.2	141.1	141.8	116.3	137.2	129.1
North State	6.0 ^a	6.0 ^a	5.0	6.5	5.6	6.6
Concord Tel	5.0	4.5	4.4	2.4	3.3	5.9
CP National	19.2	19.2	18.0	17.8	23.5	15.9
SUBTOTAL	26.2	29.7	27.4	26.7	32.4	28.4
So New England	98.0 ^a	100.0 ^a	95.0 ^a	88.9	83.0	122.5
Cincinnati Bell	93.0 ^a	81.0 ^a	61.0	49.7	78.3	116.1
SUBTOTAL	191.0	181.0	156.0	138.6	161.3	238.6
TOP 20 INDEP. TOTAL:	6475.6	6441.7	6081.8	5833.5	6102.8	6290.8
ALL OTHER INDEPENDENTS:	1262.4	997.3	872.2	1394.5	883.2	801.0
TOTAL INDEP. SECTOR:	5758.0	5439.0	4954.0	5128.0	4986.0	5091.0

RBOCs 1981-1983 construction budgets are adjusted to reflect divestiture.

^a Estimated by Telephony

cilities, fiber optic facilities and the like. The latter technology has stimulated frenzied activity, particularly with right-of-way companies like the railways, to acquire the real estate for terrestrial fiber optic links between all the major population centers in the United States.

Indeed, if all the announced fiber optic links—characterized by tremendous bandwidth—actually were to be installed, the competitive interexchange carriers might have to pay customers to make long distance calls! But there are long distances between a project announcement, installation and service availability. And the interexchange carriers, although willing to compete fiercely for customers, are unwilling to forecast spending more than \$4.018 billion in 1985 (Table 1). The portion attributable to the dominant carriers is shown in Table 3.

RBOC 1984 revenues, according to preliminary reports, fell 6%—from \$62.4 billion in 1983 to \$58.6 billion in 1984 (Table 4). The sharp increase of \$4.1 billion in RBOC operating expenses during the 1981-1983 period (Table 5) mainly is the result of transferring certain customer premise costs from the capital account to maintenance expense. The embedded CPE base has been assigned to American Telephone & Telegraph Co. (AT&T) and the net effect on RBOC operating expense for 1984 was not available for inclusion in this article. Independent operating results (Table 6) and other Independent figures still contain an unidentifiable amount for CPE. Deregulation of their CPE and its removal from the rate base is required by the end of 1987.

New days, new ways

Through these figures, 1984 emerges as a watershed year. The AT&T breakup coincided with the first real economic recovery since 1981. And the shock of divestiture was absorbed quickly, at least by the top management of the new regional Bell holding companies and AT&T—a fact that easily might be overlooked by focusing on some of the troublesome aspects of the transition.

The RHCs, indeed, pulled out all the promotional stops, seemingly intent on swiftly propelling the United

States into the information age. The network connection or gateway, of course, was to be the RBOCs. And the various lines of business, though structurally separated from the RBOCs, would nurture that connection.

The main target of this powerful promotional campaign was not the subscriber user but investors. The RHCs have placed top priority on guarding their financial flanks—a fact solidly substantiated both by operating results and the forecast.

In place behind all the promotional fervor are very tight financial controls and the priority projects are those that will maintain or increase revenues. This means business customers, especially the highly-visible large businesses which usually are clustered in small geographic areas. The RBOCs are bringing high-capacity digital services to their premises.

In the Midwest, for example, some \$840 million of Ameritech's 1985 construction budget of \$1.8 billion will be spent on fiber optic and T-carrier facilities—a 60% increase over the \$500 million spent in 1984. The percentage of digital switches in Ameritech's territory will increase from 3% currently to 31% in 1986; in the Bell Atlantic region, from 5% to 32%. And in Southern Bell's fast-growing region, the percentage of digital switches will increase from 3% in 1983 to 19% in 1985. Obviously, the RBOCs are installing technology where it counts the most.

New York Telephone, for example, derives 25% of its revenues from 1% of its business customers. Some 400 of the company's largest business customers and 5% of the next largest businesses account for approximately 70% of New York Tel's revenues. The company's territory includes lower Manhattan where the largest number of business customers are concentrated and the possibility of bypass is greatest. To serve them, New York Tel introduced packet switching in 1984, completed its fiber ring around Manhattan in 1983 and its video ring for both data and video in 1984. A 4 Mb/s (megabits per second) fiber optic facility also serves customers who need this kind of capacity.

Pacific Bell is approaching the Cal-

Continued on page 40

Table 3
Dominant Interexchange carriers (\$000,000)

	Revenues				Number of Installed Switches		
	Calendar 1984	% Mkt	Calendar 1983	% Mkt	1984	1983	1982
AT&T Comm.	35,000.0	88%	nc	91%	167	nc	nc
MCI	2,025.1*	5%	1,521.5	4%	118	98	75
GTE Sprint	1,267.4*	3%	740.0	2%	72	55	nc
Allnet	280.0*	-1%	181.1	-1%	30	27	8
UTC1	230.0	-1%	159.3a	-1%	10	nc	nc
	Construction Budget 1984	1984 Customers		% Business	Number of Employees 1984		
AT&T Comm.	1,100.0	87,000.0	9%	115,000			
MCI	1,050.0b	1,613.0c	19%	8,756c			
GTE Sprint	980.0	1,400.0	na	6,500			
Allnet	na	196.0d	47%	1,579			
UTC1	200.0	150,000.0	60%	2,300			

* estimated by Telephony

na not available

nc not comparable

a combined 1983 revenues of U.S. Telephone and United Telecom Communications, Inc. (UTC1)

b calendar year

c as of 3/31/84

d as of 9/30/84

Note: Other interexchange carrier revenues not included in this table are Satellite Business Systems (SBS) with revenues in 1983 of \$141.8 million; ITT/USTS, \$163.3 million and Western Union Long Distance Service, \$57 million. Their combined 1984 estimated revenues of \$475 million account for a 1% share of the 1984 market.

Table 4
RBOCs: Total revenues and local revenues versus toll distribution (\$000,000)

Distribution: Local & Toll Revenues						
Local Revenues		% Total Revenues	Services & Equipment	Public Phones	Message Charges	Private Lines
1983	30277.0	49%	84%	4%	9%	3%
1982	28960.0	48%	85%	3%	9%	3%
1981	25571.8	48%	85%	3%	9%	3%
Toll Revenues		% Total Revenues	Message Charges	WATS	Private Lines	
1983	29478.1	47%	67%	19%	14%	
1982	28669.7	48%	71%	16%	13%	
1981	26114.5	49%	74%	15%	12%	
Total Revenues		Toll Messages (000,000)	WATS Messages (000,000)			
1984	58600.0	na	na			
1983	62398.3	19000.4	7958.0			
1982	60050.4	18660.6	6456.8			
1981	53829.8	18061.7	5512.6			

Table 5
RBOCs: Operating expenses and
maintenance of shared expenses
(\$000,000)

	OPERATING EXPENSES			MAINTENANCE EXPENSES PER LINE		
	1983	1982	1981	1983	1982	1981
AMERITECH						
Illinois	1944.7	2029.1	1850.6	\$137	\$143	\$124
Indiana	604.9	603.0	556.0	137	141	128
Michigan	1544.4	1494.4	1402.7	141	134	125
Ohio	1257.3	1238.9	1138.4	141	143	134
Wisconsin	583.2	572.5	497.6	120	117	101
	5934.5	5937.9	5445.3			
BELL ATLANTIC						
C&P	2456.3	2362.1	2115.0	\$149	\$147	\$130
New Jersey	1730.8	1640.3	1418.1	145	143	125
Bell of PA	1832.5	1798.6	1565.2	115	112	106
	6019.6	5801.0	5098.3			
BELLSOUTH CORP.						
South Central	2913.6	2843.1	2625.4	\$157	\$160	\$155
Southern	4053.5	3879.0	3371.9	199	198	173
	6967.1	6722.1	5997.3			
NYNEX CORP.						
New England	2174.4	2068.0	1825.0	\$169	\$166	\$143
New York	4592.3	4433.4	3878.4	200	190	155
	6766.7	6501.4	5703.4			
PACIFIC TELESIS						
Pacific	5927.8	5788.9	5016.2	\$198	\$211	\$175
SOUTHWESTERN BELL CORP.						
SW Bell	5316.5	5243.0	4501.7	\$184	\$182	\$160
US WEST						
Mountain	2520.1	2442.2	2153.3	\$163	\$167	\$140
NW Bell	1402.1	1410.0	1301.4	125	125	118
Pac NW	1253.0	1176.6	1056.9	156	150	135
	5175.2	5028.8	4511.6			
SUMMARY:	OPERATING EXPENSES			MAINTENANCE EXPENSES ONLY		
	Total	% incr.		Total	% incr.	% Budget*
1983	\$42,107.4	+ 3%		\$14,407.1	+15%	34.2%
1982	41,023.1	+13%		12,534.4	+22%	30.6%
1981	36,273.8			10,309.7		28.4%

* Increase in operating expenses due primarily to customer premise responsibilities being moved from capitalized to (maintenance) operating expense during transition period prior to divestiture and deregulation.

ifornia market as though it were a new mother lode. And indeed, it is: If California were an independent nation, its economy would rank eighth on the world scale—just behind Italy and ahead of Canada. A total of 91% of its population lives in cities; approximately 20% of its over-25 residents have completed at least 4 years of college and 1 in 10 households already has a home computer.

To work this new "mine," Pacific Bell consumed half of AT&T's 1982 fiber optical production to construct a network for use during the Olympic games. But the game plan for this network extended far beyond the games: It now serves the major universities and businesses in the area and the company had 150 high capacity transport services (1.544 Mb/s networks) in operation at the end of 1984.

The RBOCs and the Independents (Table 7) are well on the way to fully digital networks. Unlike the RBOCs, Independents mainly are free to compete in the interexchange markets. Virtually every major Independent—GTE companies are a special case, because GTE acquired SPRINT from Southern Pacific—is competing or plans to compete for a share of this lucrative market. Typical of the announced plans are United Telecom's nationwide fiber optic network, the regional network of RCI, a Rochester Telephone Co. subsidiary and the regional network of LCI Communications, Inc., a company in which Alltel and Centel have a majority interest.

The five largest Independents (Table 1) account for 70% of Independent construction expenditures during the 1981-1986 period. Of their total 1985-1986 budgets, 51% will be spent for central office equipment, 33% for digital central office switches (Table 8).

For the RBOCs, the digital switching transition began later than it did for the Independents but RBOC progress is substantial. Before the decade ends, digital switches will be in place in every key location, whether RBOC or Independent.

Present but individually invisible in all of these figures are the more than 1400 small Independent telephone companies. While the RBOCs and

Continued on page 44

the large Independents have upped the stakes for any local network competitor or competing technology, these small Independents are playing grass roots America cards, the only cards they hold. Few of the small companies are directly threatened by bypass competition but all of them are affected indirectly. And the expected erosion of their revenue streams, as competition drives long distance toll pricing toward cost, concerns them mightily.

The result is that potential bypassers who may be attracted to alternate technologies must make some hard choices. The RHCs, RBOCs and large Independents can and will deploy whatever technology is needed to retain business customers and the small Independents will create local or national political flurries or storms to deter any mass exodus from the local exchange network. This convergence of interests between the large and small companies is the major impetus behind the recent United States Telephone

Assn.'s "unity" statement to which approximately 1250 companies already have subscribed.

Regulators, too, must come to terms with an industry that has its own ideas of how far and how fast prices can be driven to costs and, more importantly, who should pay for what.

Meanwhile, the RHCs, the RBOCs and the large Independents are competing with others and each other in many areas such as the sale of CPE, software, consulting services and the like. Multi-tenant services, for example, could become a billion dollar market by 1990 with both Independents and RHCs emerging as major players. In this submarket, pragmatism will triumph over principle. Both RBOCs and Independent telephone operating companies usually define multi-tenant services as invasions of franchised territory. Parent holding companies, however, have no qualms over directing a revenue stream into other channels if the alternative is losing it altogether.

"New" residential information services such as videotex, telebanking, teleshopping and the like continue to be long on promises and short on commercial fulfillment. Indeed, market performance figures are closely guarded secrets. But the appearance of such services usually is attended with great fanfare and followed by a deafening silence that says it all. Pilot projects are costly and pioneers are not storming this new frontier. The RBOCs, however, are making a strong case before the FCC for providing a local packet switched network and protocol conversion as a basic rather than fully-separated service.

Such a network service, they argue, is a prerequisite for home information services to become economically viable. The FCC has granted a waiver, permitting certain X.25- and X.75-based services but has delayed action on other important aspects of the waiver petition.

Videoconferencing is another service
Continued on page 48

Table 8
Top 20 Independents:
1981-1984 operating results (\$000,000)

	OPERATING REVENUES				OPERATING EXPENSES				TELECOM PLANT ASSETS			
	1984	1983	1982	1981	1984	1983	1982	1981	1984	1983	1982	1981
GTE (Domestic)	8900*	8369	7812	6864	6400*	5759	5193	4425	25448	24107	22448	20607
United Telecom	2109	1968	1829	1640	1683	1560	1451	1285	5718	5419	5192	4365
Continental	1557	1436	1332	1225*	1000	929	876	810*	4198	3982	3726	3420
Centel Corp.	771	720	691	634	494	458	443	128	1497	1493	1487	1434
Alltel Corp.	489	446	398	346	380	348	305	262	1610	1515	1410	1309
Puerto Rico Tel	350	354	296	248	259	237	218	193	1183	1105	1038	997
Rochester Tel	256*	238	222	205	141*	132	126	114	630*	606	582	564
Century	108	99	92	77	84	76	71	59	360	334	307	276
Lincoln Telecom	126	121	116	109	84	84	79	69	359	346	336	321
TDS	93	83	71	61	66	61	52	44	342*	298	271	221
Commonwealth	111*	98	82	74	98*	90	75	79	246*	226	209	192
Pacific Telecom	129	108	92	77	105	88	74	59	316	292	242	214
Anchorage Tel	99	91	73	65	75	68	62	57	172	157	157	132
Citizens Util.	98	81	69	60	29	26	23	20	275	257	236	206
Illinois Cons.	53	54	49	41	34	38	36	29	128	128	108	98
North State	35	33	27	23	19	18	16	14	81	77	72	68
Concord Tel	25	22	20	20	14	14	13	12	68	65	62	60
CP National	69*	62	54	33	43*	39	34	22	197*	185	173	154
So New England	1268*	1183	1081	1003	805*	765	745	664	2475*	2424	2341	2190
Cincinnati Bell	462*	428	397	357	298*	278	271	241	1010*	989	967	926

* estimated by Telephony

Table 7
RBOCs and Independents:
digital transition 1983-1986

ACCESS LINES (000):

	Installed Jan. 1	New & Replaced	% Base	Removed	% Base	Installed Dec. 31	% Digital
TOP 5 INDEPENDENTS:							
1986	20,326	2,735	13.1%	(2,312)	11.4%	20,749	48%
1985	19,926	3,056	15.3%	(2,656)	13.3%	20,326	37%
1984	19,334	2,323	12.0%	(1,731)	9.0%	19,926	24%
1983	19,033	1,655	8.7%	(1,354)	7.1%	19,334	14%
Subtotal:		9,769		(8,053)			
RBOCs:							
1986	92,027	10,052	10.9%	(7,615)	8.3%	94,464	22%
1985	89,394	8,676	9.7%	(6,043)	6.8%	92,027	13%
1984	86,779	6,918	8.0%	(4,303)	5.0%	89,394	4%
1983	84,961	6,596	7.8%	(4,778)	5.6%	86,779	-1%
Subtotal:		32,242		(22,739)			
TOTAL INDUSTRY*:							
1986	117,785	13,405		(10,407)		120,783	26%
1985	114,605	12,299		(9,119)		117,785	16%
1984	111,243	9,688		(6,326)		114,605	7%
1983	109,021	8,650		(6,428)		111,243	3%
Total:		44,042		(32,280)			

* top 5 independents and RBOCs account for 95% of U.S. access lines.

Estimate assumes 2.7% average annual net line growth over four-year 1983-1986 period. Of the 42 million lines added, 32.5 million (77%) will be digital.

CENTRAL OFFICE SWITCHES:

	Installed Jan. 1	New & Replaced	% Base	Removed	% Base	Installed Dec. 31	% Digital
TOP 5 INDEPENDENTS: HOSTS & REMOTES**							
1986	7,201	637	8.8%	(569)	7.9%	7,269	37%
1985	6,994	830	11.9%	(623)	8.9%	7,201	29%
1984	6,779	615	9.1%	(400)	5.9%	6,994	20%
1983	6,650	397	6.0%	(268)	4.0%	6,779	18%
Top 5 Total:		2,479		(1,860)			
RBOCs: HOST SWITCHES ONLY							
1986	9,258	968	10.5%	(1,061)	11.5%	9,165	24%
1985	9,299	623	6.7%	(664)	7.1%	9,258	13%
1984	9,418	293	3.1%	(412)	4.4%	9,299	7%
1983	9,509	292	3.1%	(383)	4.0%	9,418	3%
RBOCs Total:		2,176		(2,520)			

** top 5 independent figures show increase in installed base over 1983-1986 because hosts and remotes are included in count. Top 5 independents historically have represented 60% of independent installed switch base.

vice for which hopes are as high as the risks. Isacomm, Inc., a United Telecom company, for example, is investing approximately \$20 million up front in its video conferencing product called "The Meeting Channel."

The company's senior vice president, Anthony F. Zalenski, recently demonstrated the system to TELEPHONY and explained its relation to other United projects—the shared-tenant venture with Olympia & York and the nationwide fiber optic network. According to Zalenski, United's fiber optic network will lower video transmission costs at the same time the shared-tenant operations are expanding the number of video conferencing rooms.

This, complemented by current sales to very large companies and the advent of desk-top facilities, is expected to make videoconferencing a viable commercial service.

Cellular is now

Unlike new information services whose promises must be left for the future to judge, cellular mobile radio service is available now. The RHCs, the Independents, the radio common carriers (RCCs) the specialized common carriers (SCCs) and a host of other entrepreneurs were quick to recognize a once-in-a-lifetime opportunity.

When the Federal Communications Commission (FCC) announced that it would license only two providers—a wireline company and a non-wireline company—in each cellular metropolitan serving area (MSA), results were swift. Competing wireline applicants quickly formed alliances. And the FCC's lottery authority prodded the balky non-wireline applicants toward similar alliances.

In the top 30 MSAs, virtually all of the wireline systems and half of the non-wireline systems were in operation as 1984 ended. (Table 9.) In the 31-60 MSAs, all of the wireline systems are expected to be operational by the end of 1985 along with many systems in the 61-90 MSAs. The non-wireline systems in these markets will follow the same pattern, although some delays may occur in areas where applicants are slow to reach an accommodation.

The top 30 MSAs, many believe,
Continued on page 52

constitute approximately 65% of the total cellular market. If the estimate is accurate, it suggests that the 31-90 market is less attractive and that a below-90 market may not exist. The answers lie in the economic realities of production and consumption: How

far will equipment prices fall, once the top markets have justified mass production? When will calling traffic increase sufficiently to justify substantial price reductions which, in turn, will stimulate increased calling and so on? There are no easy answers

to these cellular questions.

Nor are there any easy telecommunications answers, if "easy" means a return to the stable ways of the former monopoly. Change, to compound the cliché, is upsetting!

Continued on page 54

Table 8
Estimated CO equipment (a) versus switch (b) spending (\$000,000)

TOP 5 INDEPENDENTS:

	1986		1985		1984		1983	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
GTE (Domestic)	1,300	793	1,253	764	1,130	689	1,009	646
United Telecom	324	226	327	219	269	172	258	165
Continental	169	142	169	142	166	139	222	176
Centel Corp.	81	72	85	71	85	77	86	78
Alltel Corp.	75	35	74	31	55	25	52	16
Subtotal:	1,949	1,268	1,908	1,227	1,705	1,102	1,627	1,081
% Budget (a):	51%		51%		49%		49%	
% Budget (b):		33%		33%		32%		33%

RBOCs CONSOLIDATED:

	1986		1985		1984		1983	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
	6,413	3,264	6,566	3,598	5,604	2,736	5,260	2,546
% Budget (a):	45%		46%		43%		42%	
% Budget (b):		23%		25%		21%		20%

TOTAL RBOCs & TOP 5 INDEPENDENTS:

	1986		1985		1984		1983	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
	8,362	4,532	8,474	4,825	7,309	3,838	6,887	3,627
% Budget (a):	46%		47%		44%		44%	
% Budget (b):		25%		27%		23%		23%

NOTE: RBOCs and TOP 5 INDEPENDENTS represent 91% of total independent and RBOCs spending over 1983-1986.

And even the monopoly's critics occasionally seem to be longing for the good old days.

This review and forecast, however, does not contain a nostalgia factor. The figures supplied by the carriers are sufficiently "self-checking" to make them authoritative. They reveal that competition, the objective that led to upsetting the old ways, is working, albeit imperfectly. Nevertheless, the market forces of supply and demand are more or less visible in all market segments.

The local exchange segment, for example, is a bastion of conservative management. In the years before and after divestiture, both RBOC and Independent budgets exceeded actual spending levels. Obviously, their budgets are not blank checks but a quantitative means of identifying and classifying potential projects. Just as obviously, continuous monitoring of the budgets is bringing projects into

near-real-time alignment with demand. Projects that can be deferred are being deferred. Consequently, spending is less than the budgeted amount.

The risk inherent in this process is the temptation to defer projects that really ought to be done. In 1985, such projects likely have higher priority and actual spending more closely may match budgeted amounts.

Nevertheless, the local exchange forecasts reveal a mature telecommunications network. There are no signs of explosive growth, runaway demand or the early emergence of significant new revenue streams. Instead, there are tight financial controls and a steady stream of rate increase requests before the appropriate regulatory bodies.

The business plan is clear: Minimize costs. Maximize revenues. Bombard the court and the regulators with requests for waivers to every

condition that puts the local exchange network at a competitive disadvantage and, through separate subsidiaries, pursue opportunities forbidden to the RBOCs.

Even in the partially deregulated interexchange market segment, no carrier is pinning its hope for success on market growth alone. Each one expects a share of the growth, of course, but the primary objective is a greater share of AT&T Communications' market. AT&T's objective is keeping its market share and shedding its competitive handicap. The Independents who are planning regional networks that include their own local exchanges have reduced their risks while increasing their chances of success: Much of their locally generated toll traffic will flow to the regional network.

Telecommunications equipment suppliers, for most of whom competi-

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Table 9
Top 30 U.S. cellular markets: a progress report

MSA Rank	CITY	WIRELINE LICENSE		Start Date	SWITCH		MSA Rank	CITY	WIRELINE LICENSE		Start Date	SWITCH	
		Wireline License	Nonwireline License		Wireline License	Nonwireline License			Wireline License	Nonwireline License		Wireline License	Nonwireline License
17	ATLANTA	BellSouth Mobility	GenCell	84 20	Motorola	EMX 250	21	MILWAUKEE	Ameritech Mobile		84 30	AT&T Autoplex 100	
14	BALTIMORE	Bell Atlantic Mobile	Wash-Balt Cellular	84 20	AT&T Autoplex 100		15	MINNEAPOLIS	Milwaukee Tel. Co.		84 20	Motorola	EMX 250
6	BOSTON	Nynex Mobile	Yankee Celltel	84 40	AT&T Autoplex 100				NewVector		84 20	GE-Northern Telecom	
25	BUFFALO	Nynex Mobile	Buffalo Tel. Co.	84 20	Motorola	EMX 250	29	NEW ORLEANS	MCI/Cellcom		84 30	NEC NEAX 61	
3	CHICAGO	Ameritech Mobile	Rogers Radiocall	83 40	AT&T Autoplex 100				BellSouth Mobility		84 30	AT&T Autoplex 10	
23	CINCINNATI	Ameritech Mobile	Southern Ohio Tel.	84 40	AT&T Autoplex 100				Radiofone			Motorola	EMX 250
16	CLEVELAND	GTE Mobilnet	Northern Ohio Cellular	84 30	Motorola	EMX 250	1	NEW YORK	Nynex Mobile		84 20	AT&T Autoplex 100	
9	DALLAS	SW Bell Mobile	Metroplex	84 30	AT&T Autoplex 100				Cellular Telephone Co.		85 30		
10	DENVER	NewVector	MCI/McCaw	84 40	GE-Northern Telecom		4	PHILADELPHIA	Bell Atlantic Mobile		84 30	AT&T Autoplex 100	
5	DETROIT	Ameritech Mobile	Detroit Cellular	85 10	Ericsson	AXE 10			AWACS		85 30		
10	HOUSTON	GTE Mobilnet	Houston Cellular	84 20	Motorola	EMX 250	26	PHOENIX	NewVector		84 30	GE-Northern Telecom	
28	INDIANAPOLIS	GTE Mobilnet	Indianapolis Telephone	84 10	Motorola	EMX 250	13	PITTSBURG	Metro Mobile		84 40	AT&T Autoplex 100	
24	KANSAS CITY	SW Bell Mobile	MCI/McCaw/MidAmerica	84 30	Motorola	EMX 250			Bell Atlantic Mobile		85 10		
3	LOS ANGELES	PacTel Mobile	LA Cellular Telephone	84 30	AT&T Autoplex 100		30	PORTLAND	GTE Mobilnet		84 30	Motorola	EMX 250
12	MIAMI	BellSouth Mobility	Florida Cellular	84 30	AT&T Autoplex 100				Interstate		85 10	Motorola	EMX 250
					Anaconda	Ericsson	11	ST. LOUIS	SW Bell Mobile		84 30	AT&T Autoplex 100	
									CyberTel		84 30	Motorola	EMX 250
							18	SAN DIEGO	PacTel Mobile		85 20	Motorola	EMX 250
									GenCom				
							7	SAN FRANCISCO	GTE Mobilnet		85 10	Motorola	EMX 250
									Bay Area Cellular		85 20	Motorola	EMX 250
							27	SAN JOSE	GTE Mobilnet		85 10	see San Francisco	
									Bay Area Cellular		85 20	see San Francisco	
							20	SEATTLE	NewVector		84 30	GE-Northern Telecom	
									Interstate		85 10		
							22	TAMPA	GTE Mobilnet		84 30	Motorola	EMX 250
									Bayphone of Tampa			Motorola	EMX 250
							8	WASHINGTON	Bell Atlantic Mobile		84 20	see Baltimore	
									Wash-Balt Cellular		83 40	see Baltimore	

* proposed switch in FCC filing.

tion is not new, have a well-defined carrier market of some \$23.634 billion. However, this glittering target has attracted worldwide competitors as a flame attracts moths. For many products, therefore, competition has created a buyer's market.

The fierce competition for the CPE segment, for example, has lowered prices to the hang-on-for-dear-life level. The RBOCs have rejuvenated Centrex, making it competitive in features and price with PABXs. And the mass media has been filled with retailer ads, aimed at moving a stagnant

inventory of telephones, cordless phones and the like off their shelves. Central office digital switches have been offered at a price-per-line that is reminiscent of the years-ago rule of thumb for step-by-step systems.

Telecommunications competition clearly is going about its business: Except where regulation says otherwise, competition is driving prices toward costs and shifting costs to cost causers. It is challenging projects, comparing them with demand, approving some and deferring others. It is redistributing market share and

shifting some responsibilities to the customer. It is creating and closing markets, evaluating suppliers (Table 10) and correcting over- and under-supply. And it is challenging the traditional players as well as new entrepreneurs.

Whether or not telecommunications ought to be doing all these things and whether or not the new order ultimately will be better than the old are questions open to debate. Meanwhile, telecommunications is doing them, and though inexperienced, doing them quite well. □

Table 10
Large user impressions of interexchange carriers*

	AGGRESSIVE MANAGEMENT	BACKUP SERVICE	COST COMPETITIVE	SERVICE QUALITY	SEE AS INTERNATIONAL
Allnet	57%	42%	56%	46%	2%
Argo Communications	33%	27%	31%	26%	3%
AT&T Communications	71%	81%	53%	85%	32%
GTE Sprint	67%	58%	68%	58%	13%
ITT/USTS	45%	44%	47%	45%	12%
MCI	84%	63%	72%	58%	19%
Satellite Business Sys.	57%	46%	51%	48%	12%
UTCI (U.S. Telephone)	44%	41%	44%	39%	5%
Western Union Long Dist. Serv.	38%	37%	42%	37%	6%

NOTE. Respondents were asked to give their impression of the interexchange carriers in each category using the scale: 3 - Excellent, 2 - Average, 1 - Poor.

* based on 150 responses from the headquarters of Fortune 1000 Industrials, Fortune 400 Service Organizations and universities with over 2,500 students.

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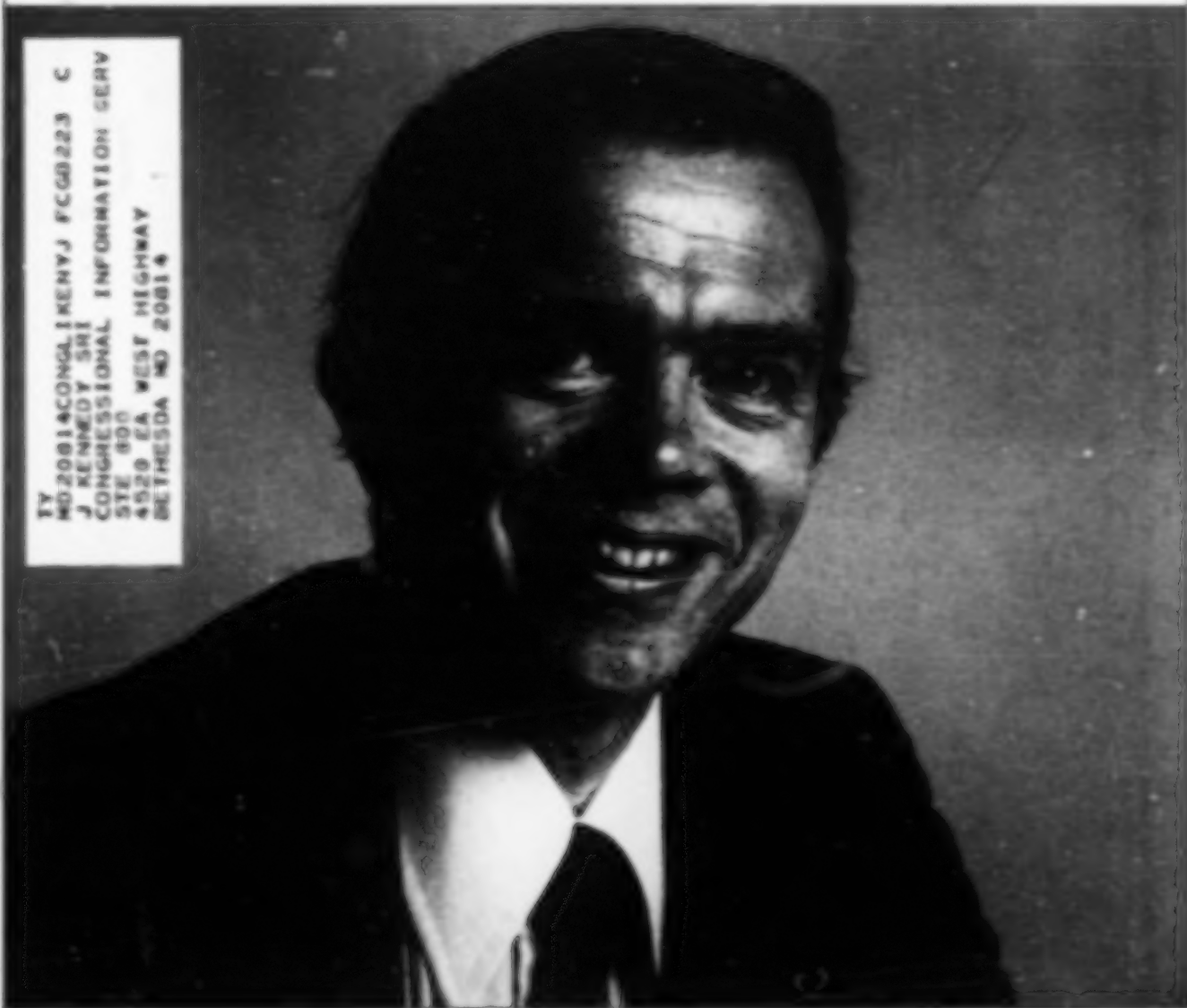
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Japanese telecommunications takes on a brand new look

ETSUZO MASUDA

TWO EVENTS are exciting Japanese businesses and consumers as well. One is privatization of Nippon Telegraph and Telephone Public Corp. (NTT) and the other is the evolution of INS (Information Network System, the Japanese version of the integrated services digital network, or ISDN).

Although the bills to privatize NTT were not enacted in the preceding

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Diet, the national legislative body, because of lack of time, agreement was reached between the ruling Liberal Democratic Party and the leading opposition Socialist Party to pass the bills in the December session. The privatization legislation, which took the form of three reform bills, now has been passed (TELEPHONY, Jan. 14, p. 13). The laws will take effect this spring. On the closing day of the past session, the chairman of the All Telecommunications Workers' Union (ATWU) expressed his view that the failure to enact the bills was

regrettable and his union would press the Socialist Party for early enactment in the next session. Considering that the ATWU is one of the largest constituents of the Socialist Party, and that all other opposition parties (except the Communists) were in favor of privatization, passage of the necessary bills was ensured. Both NTT and the private sector have been preparing for the coming competition earnestly, assuming that the necessary legislation would be passed.

Meanwhile, the Sept. 28, 1984, im-

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Table 1
Classification of carriers and applicable regulations

Category 1 carriers	Those who own their own facility		
Category 2 carriers	Those who rent telecommunications facility of others to run their business	General second class	Other than the special second class
		Special second class	Those running nationwide system or international services
	Category 1		Category 2
Commencement of business	Approval by the Ministry of Posts and Telecommunications (MPT)	General second Notification to MPT	Special second Registration to MPT
Rates, terms and conditions	Approval by MPT	Free	Notification to MPT
Publication of rates, terms and conditions	Required	Not required	Required
Duty to provide services	Required	Not required	Not required
Discontinuance of services	Approval of MPT	Notification to MPT	Notification to MPT
Report to and inspection by MPT	Report and inspection	Report	Report and inspection

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plementation of the INS model system connecting Musashino and Mitaka with central Tokyo inspired considerable enthusiasm among businesses and citizens who want to participate in this state of the art telecommunication experiment that includes digital telephony, digital facsimile, telewriting and video response systems (see story on p. 64). There were a considerable number of firms that established their branch offices or company-financed employee residences so as not to miss the opportunity to try the new communication possibilities and accumulate experience ahead of others.

Although it may seem strange to some outside observers, even the labor unions and NTT have supported privatization. The stringent regulation placed on the present NTT explains this phenomenon.

Capitalization, management and organization of NTT was stipulated in the Nippon Telegraph and Telephone Public Corporation Act, and services, rates, terms and conditions were written into the Public Telecommunications Act. NTT's president and vice president were appointed by the prime minister and their budget was approved by the Diet. Rates and charges for principal services (exchange line rental, local and toll call charges) were written into the act and other rates and charges were approved by the Ministry of Posts and Telecommunications (MPT). Wages of NTT workers were part of the budget approved by the Diet and as often as not they were set at a level commensurate with those of the deficit-creating Japan National Railroad workers. Dr. Hisashi Shinto, who was appointed president of NTT in 1981, lamented that his authority was less than that of a plant manager of a private company. He came to NTT from the shipbuilding industry, which is well known for its competitive cost reduction efforts. Shinto firmly believed that productivity of Japan's communication industry, which is vital for Japan's success in the coming information age, could not be promoted without the introduction of competition.

The ATWU, frustrated by its lack of success in efforts to raise wages and improve working conditions because of the government's policy of treating all government workers equally, put its hopes for improvement in the privatization of NTT.

Of course, industry is supporting the privatization enthusiastically be-

cause it believes privatization is a good business opportunity and could lead to reduced toll rates. Consumers are not very aware of what it will bring. At present, consumers seem to welcome the increased NTT productivity and cheaper toll rates. At one time an NTT top official announced that there would be no major increase in local rates for the next 2 years.

As for the government, which is led by the majority Liberal Democratic Party, administrative reform was its top priority and it was firmly behind the NTT privatization bills. The birth of the Nippon Telegraph and Telephone Company Ltd. on April 1, 1985, thus was assured.

Privatization bills

Three bills enacted into law are the Electric Telecommunications Business Law, the Nippon Telegraph and Telephone Company Law and the law regarding adjustment of related affairs (TELEPHONY, Jan. 14, p. 13). The Telecommunications Law stipulates terms and conditions for operating telecommunications systems in Japan. The NTT monopoly of domestic public telecommunications was abolished by the law and other companies now may enter the field

Table 2
Planned applications

Company	Application
Gakushu Kanryusha (school magazine)	Movie for video response system (VRS) Information provision through videotex
Kyowa Bank	Home banking and home shopping by videotex
Recruit (help wanted magazine)	Help wanted ads by videotex
Japan Airline	Flight schedule and reservation by videotex
Tokyo Toyopet (automobile)	Car sales by videotex
Dai-ichi Kangyo Bank	Leisure information by videotex
Mitsui Bussan Kaisha (building)	Home building information by VRS
Sacom	Home security
Nagasakiya (department store)	Home shopping by videotex
Sobu Distribution Group	Home shopping by videotex
Mitsui (installment)	Home shopping by videotex
Mitsukoshi (department store)	Home shopping by videotex
Tokyu (department store)	Home shopping by videotex Various information by VRS
Keio Toei Electric Railway	Real estate consultation by teleconference Shopping by videotex or VRS at stations and city center offices
Meiji Life Insurance	Life insurance information by VRS
PIA (town information magazine)	Movie, theater and cultural events by videotex
Kinki-Nippon Tourist	Traveling information by videotex Movies on scenic beauty on VRS
Matsumoto (department store)	Home shopping by videotex Fashion information by VRS

under conditions set forth in the law. Unlike the basic and enhanced services dichotomy adopted in the United States, the law introduces facility-based carrier and resale carrier categories and applies different regulations to each. Resale carriers are further classified into large public carriers and small special application carriers, and they are treated differently. The classification of carriers and applicable regulation is shown in Table 1.

The Nippon Telegraph and Telephone Company Law stipulates that Nippon Telegraph & Telephone Public Corp. will be dissolved on April 1 when the Nippon Telegraph and Telephone Company Ltd. (NTT) is created. It will be a company with limited liability, issuing shares one-third of which are always held by the government. NTT's executive officers and auditors will be appointed with the approval of the MPT, its annual business plan must be approved by the MPT and transfer of its major assets needs MPT approval.

Possible entrants

At least four entities are planning to enter the telecommunication market

Continued on page 45

Table 3

Business Interest in top 10 new services

As a venture	
VAN	27.8%
Videotex	22.8
CATV	21.8
Electronic shopping	17.4
Online database	14.2
Information provision by video disks	14.1
VRS	12.5
Voice response system	11.6
Information provision by floppy disks	10.9
Electronic banking	10.4
As a user	
VAN	58.7%
LAN	58.7
Online database	55.9
Videotex	46.9
Electronic mail	41.3
Teleconference	40.4
Electronic banking	37.6
CATV	33.9
Satellites	31.6
Information retrieval from disks	12.9

as facility-based Category 1 carriers. Two are Daini Den Den, NTT, advocated by the Kyocera Co., and joined by Sony, Ushio Electric and Secom, Co., Nihon Telecom, created by the Japan National Railroad. In addition, the Ministry of Construction-Japan Highway Public Corp. group and the prestigious Keidanren (Federation of Economic Organizations) are planning to establish telecommunication lines along the lucrative route connecting Tokyo and Osaka (Japan's second largest city) with Nagoya (the third largest city) located in between.

While Kyocera is the earliest starter and famous for its innovative management, it may have difficulty in acquiring the necessary rights of way, and some observers predict that some merging among the candidates may be inevitable (for instance, Daini Den Den could merge with the Japan Public Highway Corp.) Uncertainty about the access charge to be imposed by NTT for the use of the local network is another factor that greatly worries the candidates. As for the value-added carriers planning to operate on a resale basis, there are too many to cite specific names but they are mostly private systems connecting shippers, freighters and distributors, or manufacturers, suppliers and distributors allowing the use of

spare capacity in the general public subscriber service. International Business Machines Corp. (IBM) reportedly is entering the Japanese value-added network (VAN), joining the Mitsubishi Trading Company. Japan IBM, Cosmo Eighty and American Telephone & Telegraph Co. (AT&T) are also making a joint effort to introduce NET 1000 technology in cooperation with Nihon Kogyo Bank, Mitsui Trading Co., Mitsui Bank, Sony and others. NTT has its own packet switched and circuit switched data networks, but the number of subscribers is limited.

Creation of INS

NTT is committed to the creation of a nationwide ISDN as a cost effective means of carrying data as well as voice communication originating from and terminating at a single access line. NTT is planning to provide digital links to 40% of subscribers in the cities of prefectural government seats by 1987, 60% by 1990 and 100% by 1995. Optical fiber toll circuits will be laid between Tokyo, Nagoya and Osaka this year and the circuits connecting Sapporo in the extreme north and Fukuoka in the south will be completed by March 1985. NTT will not wait until the introduction of INS

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to improve existing services and its facsimile network. Digital data networks (both packet switched and circuit switched) and the videotex network will be expanded in the meantime based on existing technology. Digitization of the network will be made on a replacement basis when the service life of existing facilities expires.

An INS model system was started with due pomp on Sept. 28, 1984. Applications planned by participants are shown in Table 2.

Initial reception of the INS model system was enthusiastic, once causing the video response system to go out of order because it received too many calls at one time.

A total of 569 companies responding to a Nikkei Business magazine questionnaire showed more interest as users of new telecommunications

'Although it may seem strange . . . even the labor unions and NTT have supported privatization.'

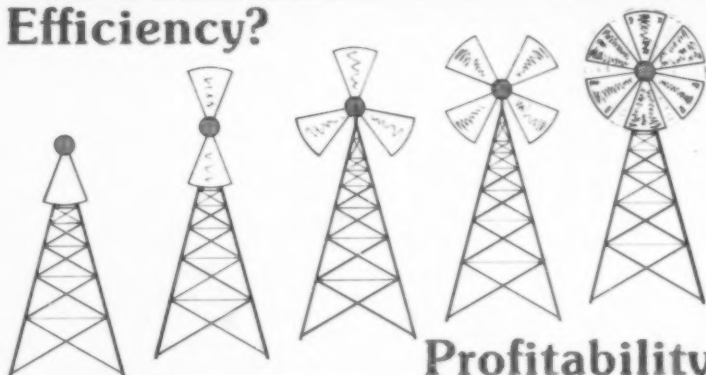
services than did investors (Table 3).

After a month of experimentation, the initial enthusiasm for the INS new services is waning somewhat. As of Oct. 31, 1984, 10,000 visitors had been received at the demonstration rooms. Approximately 165,000 calls were originated, of which 100,000 were completed and 65,000 encountered busy signals or other difficulties. Use was mostly made at the demonstration rooms and few calls were made from monitors' residences or offices. Between Oct. 15 and Oct. 19, the average number of calls originated daily from a telewriter machine was 0.63. The average number of calls originated from a digital telephone was 16.8 daily between Oct. 1 and Oct. 5, but the number decreased to 7.5 between Oct. 22 and Oct. 26.

It seems that the market for the variety of new services provided through a digital switched public network is yet to develop. However, many companies are unwilling to be left behind others on the way to the new world to be created by the INS.

Although they are driven by dreams rather than by facts, the resulting competition may bring a competitive edge to the Japanese telecommunications industry. ☐

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Stabilizing the volatile telephone instrument market

Manufacturers and retailers both are operating on razor thin margins. They must emphasize quality and service, and further educate customers about the products

RICHARD A. LINDENMUTH

IT WAS a relief to see 1984 end. For the consumer telephone industry, 1984 was not a good year despite the fact that factory sales of telephone units last year increased 54% to an estimated \$1.25 billion.

The past year was the first full year of deregulation. It certainly was a year notable for its rough and tumble competition, but it is not clear who, if anyone, really benefitted. The regional Bell operating companies burst on the scene and it was a year in which a very few firms in the consumer telephone industry made some small profits on telephones. Many more firms lost money and most firms in the consumer telephone industry are just now climbing out from under the burden of huge inventories and tiny, shrinking profit margins.

Finally, 1984 was a year of confusion in the residential telephone market which hopefully taught everyone a lesson: Consumer preference in telephones is market-driven, not manufacturer- or retailer-driven. Consumers want quality and gadgets, but not too many gadgets, and they want everything at a price they have come to expect as their due for making the jump from leased to purchased telephones. That may be a selfish posi-

'The reason so many telephone vendors and retailers are in trouble today is that they misjudged the tenacity and power of AT&T and the voracious appetites of offshore manufacturers seeking a large bite of the U.S. residential telephone market.'

tion but it is not an unexpected one.

And therein lies the problem.

But what does the market look like? Table I has some interesting statistics. If the statistics prove to be accurate, the industry will have a decent but not a spectacular year in 1985. But not all of the market confusion will disappear in 1985.

Where does all this leave the industry as it heads into the second half of the '80s? There is no longer any doubt about the retail acumen of the largest competitor in the market, American Telephone & Telegraph Co. (AT&T). AT&T is a tough competitor. It is ready, willing and able to improve its market share in 1984 and 1985, and to regain and add to the market share lost during 1982 and 1983 when several competitors were breathing down AT&T's neck.

The reason so many telephone

vendors and retailers are in trouble today is that they misjudged the tenacity and power of AT&T and the voracious appetites of offshore manufacturers seeking a large bite of the U.S. residential telephone market. Imports rose from 500,000 units in 1982 to 17 million units in mid-1983 to 34 million units by early 1984. That is more than the entire volume of domestic sales in 1984. This influx would not have been so bad if it had not fomented such consumer disillusionment with purchased telephones in general. In fact, consumer dissatisfaction with poor quality, one-piece phones in 1983 drove many consumers back to basic phones in 1984. (Some good estimates place the basic phones' share of the 1984 market at 60% of the total.)

This development is good and bad

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Richard A. Lindenmuth is President of the Business and Consumer Communications Div. of ITT Telecom, Raleigh, N.C. This article is adapted with permission from a presentation he made Jan. 6 at the Winter Consumer Electronics Show in Las Vegas, Nev.

because many of those same manufacturers of low quality, one-piece telephones are now in the traditional phone market. Consumers who are looking for a traditional phone may wind up with a cheap imitation. Consumers who have not already made the final break with their leased phone consequently may be reluctant.

The leased residential telephone market remains substantial. An estimated 45% of households already own and another 10% plan to purchase their phones, but that leaves about 35% of the market to leased phones.

Adjustments

What are the implications of this back to basics move for retailers and suppliers? The key to success for retailers is to develop solid relationships with quality manufacturers. At the same time, it is incumbent on the manufacturers to make their basic phone prices competitive and to continue to develop feature phones and cordless products which address the consumer's desire for convenience and novelty. Neither task will be easy.

Residential telephone market realities today are sobering. True, inventories are down to more acceptable levels at retail and at the manufacturing level. But price points are distressed. The average value per unit fell to \$41 from \$47 in 1983, and is expected to decline to \$40 in 1985. Low prices and the desire for quality are mutually exclusive.

The hard, cold facts are that the mean time to failure (MTTF) of basic Western Electric or ITT telephones is 7 years to 8 years and the cost of building that MTTF into the products is very close to the price required by current market realities. Margins are razor thin for manufacturers and retailers alike. In order for manufacturers to make a profit, production costs must be cut. This will lead to a degradation in quality of basic telephones. Basic telephones simply will not last 20 years anymore.

The onus is on both suppliers and retailers to make the consumer aware of this tradeoff. Consumers must realize that they can still have quality with fair prices. But they should not continue to expect infinite quality and durability, especially since they also have come to expect such features as last number redial, autodial and, increasingly, one-button access to 911 emergency numbers.

The consumer telephone industry

—both manufacturers and retailers—must work to stabilize the residential telephone market. But the industry cannot stabilize the market solely through its own exertions. Ultimately, only the consumer can stabilize the residential market.

The industry can help, however,

them through its advertising or other marketing strategies—will come back to haunt the industry. In the short run, misinformation may move phones, but in the long term it can only delay the development of a mature, stable residential telephone market that yields a fair return on

Table 1
Telephones/answering devices

Cordless telephones

	Total sales to dealers in units (thousands)	Total factory sales in dollars (millions)	Average value (dollars per unit)
1982	2000	200	100
1983	4700	400	85
1984	6300	460	73
1985	6200	445	72

Corded telephones

	Total sales to dealers in units (thousands)	Total factory sales in dollars (millions)	Average value (dollars per unit)
1982	3700	200	54
1983	15,000	525	35
1984	24,000	790	33
1985	28,000	925	33

Total telephones

	Total sales to dealers in units (thousands)	Total factory sales in dollars (millions)	Average value (dollars per unit)
1982	5700	400	70
1983	19,700	925	47
1984	30,300	1250	41
1985	34,200	1370	40

Telephone answering devices

	Total sales to dealers in units (thousands)	Total factory sales in dollars (millions)	Average value (dollars per unit)
1982	850	110	129
1983	2200	190	86
1984	3000	230	77
1985	4000	305	76

Data reflected in this table has been developed from input provided by EIA/CEG Marketing Services Committee members, other companies in the industry, and outside research firms. These figures are not derived from regular EIA Marketing Services Dept. reporting programs. Research firms providing data were: Frost & Sullivan, International Competitive Assessments, Venture Development Corp. and The Yankee Group.

and a good starting point is to begin sending clear, coherent messages to the consumer. Specifically, the industry must stop selling only on price. It must sell on the basis of quality and price. The industry must inform and guide the consumer.

The consumer must be encouraged to make an informed choice.

There are simply too many choices there today for the average person to make an intelligent buying decision. Dumb buying decisions—if the industry is perceived as having promoted

investment. And everyone in the industry wants that kind of a market to develop.

The business market

The business market is a large market which is quite distinct from the residential market. The nature of business telecommunications is changing very rapidly. The changes are creating new markets and marketing opportunities.

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being integrated into information data exchange systems. Telecommunications and computing are merging into a huge, untapped market.

Twenty million households, or 25% of all U.S. homes, are categorized as home businesses. Firms which have been in the business telephone market know there are big sales and respectable margins to be made in key systems. The market for small, easily installed electronic key systems today is worth more than \$1 billion at retail prices. In other words, the key system market is nearly as big as the residential phone market.

Nor is it difficult to evolve from being a telephone retailer to retailer and interconnect company. Many telephone retailers already have made the transition. All it requires is a good supplier or two, some sales expertise, and a repair and service capability. These three requirements may seem like they demand too much investment for the small specialty retailer and it is true that going into the interconnect business does involve a certain element of risk.

But vendors will help retailers sell 2 line phones and 6 line by 16 station key systems. The sad, worst case alternative for retailers is to settle for continued low margins and residential telephones interspersed with short boom periods as consumers replace their existing phones.

Retailers, therefore, should get into the small business market. Many suppliers are already in the market, having come from either telephony or retail-consumer businesses. Furthermore, many retailers already know both sides of the business.

Undue pessimism, like uncontrolled optimism, is unwarranted. The telephone has the potential to parallel sales of radios, and radios year in and year out rack up sales of 40 million units. Currently, the number of phones per household stands at approximately 1.7. If that figure increases to just 2.2 phones per household, there will be an additional market demand of 40 million telephones.

There will not be a market demand of 40 million telephones this year or next, but gradually that huge market will develop.

When this incremental residential potential is combined with the potential of the business market, which by its nature will be more profitable, there is room for retailers and suppliers alike which are smart enough to help stabilize the telephone business. □

The dollars in the bypass dilemma

CARL THORSEN

CHANGES IN the Bell System, the regulatory environment and public attitudes toward telephone rates suggest this may be the right time to re-examine the principles that have guided toll service ratemaking over past decades.

Recently, much attention—including the attention given to Docket 78-72 of the Federal Communications Commission (FCC)—has been focused on the threat of bypass, particularly uneconomic bypass caused by the recovery of large amounts of non-traffic sensitive (NTS) costs in message toll usage prices. There is no doubt about the importance of this issue.

But it appears the questioning that has been going on has failed to focus on a key point: the possibility that the toll rate structure may be aggravating the problem of uneconomic bypass.

Today, traditional ratemaking concepts should be examined. Are toll prices economically justifiable and sustainable, given traffic characteristics, costs and their allocations and demand elasticities? And, pending FCC decisions on applying fur-

ther end user charges, should alternative means be sought to address the uneconomic bypass threat?

In the face of bypass, competition and the need for sustainable prices, the Bell operating companies (BOCs)—and American Telephone & Telegraph Co. (AT&T), since it, too, provides toll services under a similar rate structure to the operating companies—should carefully consider some key questions and, perhaps, if is merited, break with tradition in the future pricing of message toll services. Specifically:

- How is NTS cost currently recovered in day, evening and night rates?

- How is NTS cost currently recovered from each toll mileage band (or group of bands such as short, medium or long haul) for the three rate periods?

- Are the current day, evening and night rate periods properly related to current or forecast traffic patterns and costs?

- Are the current 40% and 60% off-peak discounts optimal?

- Do the current toll rate structures and discount periods properly recover traffic sensitive day, evening and night rate period costs?

- To what extent, if any, should access fees be peak-related and how should the peak be defined: nationwide, company, local access and

transport area (LATA), end office?

- Should access fees distinguish set up and holding time costs?

- What is the impact of the current access fee rate structure on the current toll schedule?

- What are the elasticities of demand by time of day, class of customer and initial period versus holding time?

Toll pricing issues

Although it may be easy to specify what portion of costs are traffic sensitive, defining the peak is another matter. In fact, the Bell System may have been misnamed from a peak-pricing standpoint: It was always more a huge collection of individual parts or exchanges with distinct operating characteristics in terms of load factors and peak calling times, that it was a unified system. This is just as true today as it was before divestiture.

However, AT&T is now more of a system than the BOCs, which comprise thousands of central offices. From point of presence (POP) to POP, AT&T has great opportunities to concentrate traffic and ensure full switching and load balancing.

Extensive alternate routing provides further load balancing potential. Extensive alternate routing is unavailable to local Class 5 offices

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Carl Thorsen is Manager in Telecommunications Regulatory and Advisory Services for Coopers & Lybrand, an accounting and consulting firm based in New York. This article has been adapted from one that appeared in Gateway Management Issues, Vol. 1, No. 1. Copyright 1984, Coopers & Lybrand (USA).

and only slightly available in the intra-LATA networks. Serving four time zones also increases the hours AT&T can use switching and transmission facilities.

Due to AT&T's operating characteristics, there may be no true peak. But during the day and evening, load is fairly level from POP to POP. From a cost standpoint, this pattern does not favor discounts after 5 p.m. The need to review off-peak rate periods and off-peak discounts is further strengthened in light of non-peak related access fees that now represent local rather than system characteristics.

Despite the fact that many, if not most, central offices peak between 5 p.m. and 10 p.m., a system view leads to the historic notion of offering price discounts after 5 p.m. and on weekends. This causes two major problems from a system perspective. First, it misdirects price signals to customers, primarily telling residence users to make evening and night calls. Second, and most important, it allocates some traffic sensitive evening peak office costs to day toll rates.

So, daytime users—primarily business customers—are assuming more than their own capacity costs. New York Telephone's new local calling peak period of 9 a.m. to 9 p.m. recognizes that peak conditions are occurring throughout the system in individual end offices.

The pricing-usage imbalance is important because the same switches carry intra-LATA calls and calls to access inter-LATA toll carriers. Implicit differences between system-wide traffic sensitive cost apportionment and office by office or class of customer costs call into question the traditional toll rate discount periods.

Compounding the threat

Two larger reasons may be aggravating the uneconomic bypass threat. They are the disproportionate recovery of NTS costs between residence and business customers and the construction of too much distance sensitivity in toll rates. An operating company study of 1983-84 pre-divestiture intrastate toll characteristics shows that day calls make a far greater contribution to net revenue than evening or night calls (Table 1).

Thus, uneconomic bypass is spurred by the disproportionate burden placed on daytime prices in the rate structure's contribution spread. Contributing per minute of use also adds

Table 1

Time and money: average contribution per message and minute

Rate period	Revenue requirement per message	Revenue per message	Contribution above cost per message
Day	50.6¢	\$1.22	71.4¢
Evening	84.2	1.30	45.8
Night	20.4	0.72	51.6

	Contribution per message	Holding time per message	Contribution per minute
Day	71.4¢	3.8846 mins.	18.38¢
Evening	45.8	7.4931	6.11
Night	51.6	6.4818	7.96

Table 2

Contribution of day period calls by distance

Per message				Per minute	
Mileage	Cost	Revenue	Contribution	Average holding time	Average contribution
0 to 8	\$ 0.335	\$ 0.28	\$ (0.055)	3.3409	\$ (0.0165)
9 to 10	0.332	0.42	0.088	3.4336	0.0256
11 to 16	0.420	0.58	0.160	3.6086	0.0443
17 to 22	0.374	0.77	0.396	3.6818	0.1075
23 to 30	0.511	0.94	0.429	3.7409	0.1147
31 to 40	0.417	1.09	0.673	3.8699	0.1739
41 to 55	0.458	1.40	0.942	3.9647	0.2376
56 to 70	0.574	1.54	0.966	4.0173	0.2405
71 to 100	0.634	1.65	1.070	4.1214	0.2596
101 to 148	0.715	1.82	1.105	4.0546	0.2725
149 to 432	0.727	2.00	1.273	4.2162	0.3019

to uneconomic bypass with uneven distribution among toll users.

Elasticities of demand may call for uneven recovery of costs and contribution. But it is far from clear that the focus and level of any recovery bias is related to demand, either before or after divestiture.

In fact, elasticity considerations, as reflected by the rule of inverse elasticity (or Ramsey pricing), are the only rationale for disproportionate recovery of NTS costs. Yet, it does not appear sustainable to load these costs onto daytime business traffic, the area most susceptible to bypass. This disproportionate recovery of NTS costs also is crucial in determining the true financial consequences of bypass or loss of market share, since loss of day traffic would inflict a greater financial toll than loss of evening traffic.

The current rate structure also may be contributing to uneconomic bypass by recovering a greater portion of NTS costs in the longer distance calling bands than in the short haul, as Table 2 indicates. Table 2 is based on the operating company study mentioned in connection with Table 1.

The complex issues surrounding the need to deaverage rates among geographic areas and long distance routes are causing wide discussion in the industry. Certainly, it is an area that will require action in the future. But for the moment it seems there is more to be gained by addressing the problems surrounding the average rate schedules.

The significance of this issue should not be underplayed. The BOCs and AT&T can file tariffs on

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the state and federal levels to modify toll pricing structures while reserving the arguments on toll revenue needs, proper jurisdictional assignment of NTS costs and rate deaveraging.

While the FCC is delaying end user charges, the BOCs and AT&T may want to develop contingency plans that could include, if justified by cost and demand analysis, a decrease in day rates coupled with increases in evening and night rates, a lengthening of the day peak period coupled with day peak price decreases and increases in short haul traffic coupled with decreases in long haul traffic.

Any one or all of these pricing approaches would:

- Cut day rates (reducing bypass incentives);

- More rationally distribute the contribution per minute of use from all toll customers;

- Reflect the current access fees, which are not time of day sensitive; and

- Resemble the effect of end user charges, at least to the extent that residential customers would pay, as a class, more of the non-traffic sensitive costs; larger residential users would pay proportionately more, while business users would derive economic incentive to continue using the network.

Any attempt to realign the toll rate structure, of course, must be accompanied by elasticity of service demand data to determine the best steps to take.

Access fees

In a major departure from past pricing practices, either intentionally or by oversight, the FCC access charge decision does not call for time of day pricing of carriers' carrier charges. This omission has provoked many people to ask the FCC for changes in the access rate structure in future interstate and intrastate rate applications.

The impact of the FCC decision as

Table 3
Night interstate toll rates
and access fee charges
(for 5 minute call)

Toll mileage band	Price	Access fees	Net revenue
1 to 10	\$ 0.38	\$1.00	\$ (0.62)
11 to 22	0.51	1.00	(0.49)
23 to 55	0.64	1.00	(0.36)
56 to 124	0.82	1.00	(0.18)
125 to 292	0.86	1.00	(0.14)
293 to 430	0.91	1.00	(0.09)
431 to 925	0.94	1.00	(0.06)
926 to 1910	0.96	1.00	(0.04)
1911 to 3000	1.08	1.00	0.08
3001 to 4250	1.12	1.00	0.12
4251 to 5150	1.16	1.00	0.16

Note: Although on May 25 the FCC ordered adjustments to access fees and the AT&T message toll service rate structure, these changes do not materially affect the cost-price relationships in this and other tables or the conclusions in this article.

it stands, though, is twofold. First, non-peak related carrier charges have a direct and dramatic effect on the efficacy of AT&T's current message toll service rate structure. Second, the current access fee structure raises the related questions of whether access fees should be peak-related and, if so, what the peak is.

To highlight the impact of access fees on AT&T, a comparison of AT&T's night rates to the charges it will pay to the local operating companies under the most recent National Exchange Carrier Assn. (NECA) tariff shows that much of AT&T's traffic—even before considering AT&T's own costs—is not profitable (Table 3). Night rates constitute Monday to Friday and Sunday from 11 p.m. to 8 a.m. and all day Saturday and Sunday until 5 p.m.

Any stimulation of night and weekend calling only serves to reduce AT&T's net operating revenues unless the stimulation is presupposed in access fees determined by the BOC. These and potential future revenue deficiencies must be recovered in day or evening rates. This shift inflates the price of a day call and further aggravates uneconomic bypass since most business toll calling is during the day. One of two solutions is suggested; either peak related access fees or, as previously discussed, changes in the toll rate structure.

Peak related fees

Peak related access fees may not be the panacea for current pricing anomalies because most of the carrier charges are not related to traffic sen-

sitive costs. Five major elements comprise interstate carrier access fees filed by NECA (Table 4).

These charges apply to both originating and terminating minutes of use. Therefore, a 1 minute call would incur an 18.04¢ access fee. When coupled with a 10¢ charge for billing each message, the total access fees for a 1-minute call become 28.04¢.

Billing charges aside, of the 18.04¢, only local transport and switching are truly usage sensitive, and they make up 4.38¢ or almost 25% of the current access charges. So, the non-peak related or NTS costs amount of 13.66¢ per minute of use and they should be recovered in every minute of use, regardless of time of day. Most of the costs of billing should be treated as non-traffic sensitive as well. It is the actual elasticity characteristics that should dictate departures from the 13.66¢ average.

Only a small portion of the carrier charges, then, are usage sensitive and true candidates for peak/off-peak pricing. So it is doubtful in the short run whether peak access fee pricing is worth pursuing and, even if it were, that it could significantly alter the relationship between AT&T's toll rate structure and access fee charges.

The actual difference between peak and off-peak access fee charges also depends on how the peak period is related to actual end offices, the peak period may extend from mid-morning to late evening hours, covering the majority of all carrier access traffic. In this case, peak/off-peak pricing would have little impact on the

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Table 4
Cents
per minute
of use

Carrier common line	6.0300
Line termination	0.7900
Local transport (1-8 miles)	1.2100
Local switching	0.9800
Intercept	0.0097
Total	9.0197

carrier's access fee prices.

In short, the FCC's decision with respect to non-peak related access fees may be more right than wrong.

However, the question of toll price realignment remains open. The AT&T toll rate day schedule can be put in exactly the opposite perspective as the night rate period schedule. Since access fees comprise a large share of AT&T's costs and because AT&T's own operating costs are fairly insensitive to the distance of a toll call, comparing the price of a 5-minute call, less access fees, should highlight the net revenue available to AT&T to defray its own expenses (Table 5).

These characteristics point to the potential requirement to reduce day prices and the contribution above cost in longer haul mileage bands. Bypass potential should not be evaluated only on the basis of NTS cost assignment, but also on the basis of toll rate structure revenues-cost disproportionalities.

Recent attention and energy has not been misdirected to uneconomic bypass and the need to reduce the apportionment of NTS costs to usage sensitive prices. However, the efficacy of current BOC and AT&T

Table 5
Day Interstate toll rates
and Access Fee Charges
(for 5-minute call)

Toll mileage band	Price	Access fees	Net revenue
1 to 10	\$.96	\$1.00	\$0.04
11 to 22	1.28	1.00	0.28
23 to 55	1.60	1.00	0.60
56 to 124	2.05	1.00	1.05
125 to 292	2.14	1.00	1.14
293 to 430	2.27	1.00	1.27
431 to 925	2.34	1.00	1.34
926 to 1910	2.40	1.00	1.40
1911 to 3000	2.70	1.00	1.70
3001 to 4250	2.80	1.00	1.80
4251 to 5150	2.91	1.00	1.91

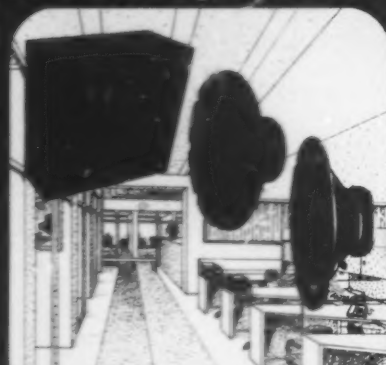
toll rate structures has been overlooked in addressing the post-divestiture environment and in dealing with the apparent reluctance of regulators to implement cost shifts to basic exchange rates.

In view of the current regulatory and political climate, the BOCs and AT&T should consider toll rate realignments. This is more than a stop-

gap solution to pressing problems but, rather, a legitimate short and long term strategy based on costs, usage characteristics, elasticities and non-peak related access fees.

NTS cost allocations to message toll service are the primary cause of the bypass problem. However, the toll rate structure may be providing further impetus. □

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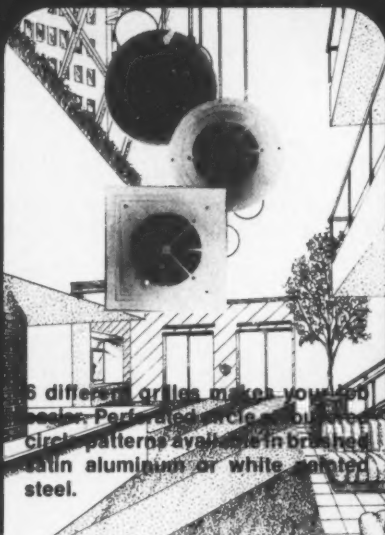


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Cover art by Leon Demoyica

A look at world telecom spending reveals that while total spending is a healthy sum, there is no doubt that sovereign nations are concerned more with inflation than growth. Weighing the budgets against the erosion of inflation reveals that only a few nations will stay even.

1985 world telecom spending—a struggle to stay even

CZATDANA INAN, MARKET RESEARCH DIRECTOR, and DEL MYERS, EDITOR

Table 1
Common carriers world telecommunications spending: 1983-1985 (\$000,000)

Zone	Region	Spending in Current US\$			If Spending Had Increased 6% Annually in 1983 US\$*	
		1983	1984	1985	1984	1985
1	North America	23,361	24,964	27,014	25,679	28,227
2	Africa	1,963	1,852	1,670	2,157	2,372
3-4	Europe	22,625	21,945	21,967	24,870	27,337
5	South & Central America	2,549	2,595	2,936	2,802	3,080
6	South Pacific	3,275	2,848	3,870	3,600	3,957
7	USSR	6,000#	6,400#	6,750#	6,595	7,250
8	Far East	11,433	11,383	11,637	12,567	13,814
9	Middle East	3,487	3,230	3,349	3,833	4,213
		74,693	75,217	79,193	82,104	90,250

* assumes 3.7% inflation annually, based on US GNP deflator (1984)

extrapolated

THE WORLD's 1985 telecommunications spending plans mirror the state of the world's economy and the collision of priorities within and between nations.

In developed countries, balancing the conflicts between procurement, industrial policy and non-tariff protectionism requires diplomatic skills far beyond those needed to simultaneously balance tea and cake.

In the under-developed and developing countries, declining raw material prices and high interest rates continue to frustrate their hopes and optimistic plans. For some nations, the loans that were rescheduled during the financial crises of 1981-1983 are coming due in today's earnings; for others, the choice often comes down to food, not phones.

The \$79.2 billion world spending plans (Table 1) reflect tight management controls at companies and PTT administrations throughout the world.

For comparison, Table 1 also provides an interesting contrast: The three left-hand columns contain the real-world data furnished to TELEPHONY by the companies and PTTs responsible for the major share of the expenditures. The two right-hand columns show what the figures would have to be to match forecasts which assert that world telecom capital expenditures are growing annually at a

rate of 6% or more, expressed in 1983 dollars.

And the data furnished to TELEPHONY is uniquely current. More than 80%—38 of the 43 non-North American carrier expenditures (Table 2, Column A)—are based on verified reports made in January 1985. Some reports were made less than two weeks prior to the date of this issue of TELEPHONY.

The exchange rates (Column C) correspond to U.S. Federal Reserve system rates on the first business day of the year—the same rates that apply

to cable transfers payable in foreign currency. The inflation rate of 3.7% (Column B) corresponds to the increase in the U.S. gross national product deflator for 1984.

This methodology is necessary, because the U.S. dollar is the world's main trading currency and main currency reserve. The \$79.2 billion world spending forecast is, therefore, a bottom-line figure that can be inflated or deflated to suit various perceptions of monetary value. Venezuela's devaluation, for example,

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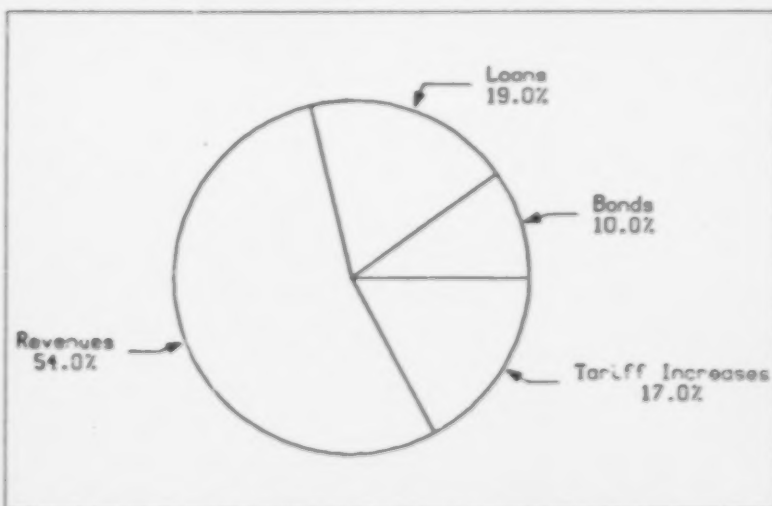


FIG. 1 Korea's budget funding for 1982-1986 (U.S. \$6.547 billion).

Table 2
1983-1985 world construction expenditures (\$000,000)

		Current US\$ (a) versus IF \$1 increase in 1982 Constant US\$ (b)							
		(a)			(b)				
1/1/84	% on	Spending in			IF Budgets				
Equipped	Serv	Current US\$			Increased in				
Lines					Constant 1982 US\$		Monetary Units = US\$ 1		
		1982	1984	1985	1984	1985	1982	1984	1985
Zone 1: NORTH AMERICA									
United States							1,000	1,000	1,000
99,990.0	89%								
27,660.0	96%								
na									
Canada							1,230	1,246	1,323
11,833.0*	89%								
Bahamas							1,000	1,000	1,000
29.1	83%								
9.4	83%								
216.0	77%						1,000	1,000	1,000
76.0	81%						1,811	3,399	4,667
83.0	80%						2,400	2,400	2,400
Trinidad & Tobago(b)									
129,836.9									
KNOWN TOTALS		22,192.1	23,716.1	25,662.8	24,395.2	26,815.6			
Extrapolated		23,361.0	24,964.0	27,014.0					
Zone 2: AFRICA									
120.0*	66%						12,623	13,834	15,824
2,259.0	87%						1,074	1,230	2,016
66.0	53%						0,927	1,464	2,189
103.0*	75%						0,925	1,132	1,513
Zimbabwe									
2,548.0									
KNOWN TOTALS		981.4	925.8	849.6	1,078.8	1,185.7			
Extrapolated		1,963.0	1,852.0	1,670.0					
Zone 3 & 4: EUROPE									
2,570.0*	85%						16,710	19,473	22,285
3,275.0	89%						46,690	96,340	63,580
134.3	75%						0,488	0,568	0,651
Cyprus							8,365	9,985	11,337
1,022.0	90%								
1,400.0*	85%								
Denmark									
731.0	75%						5,282	5,853	6,617
1,752.0	82%								
24,412.0	87%						6,726	8,445	9,715
27,431.0	86%						2,374	2,761	3,173
28,416.0	49%						1372,000	1680,000	1923,000
6,941.0	84%						2,624	3,103	3,580
1,700.0*	85%						7,056	7,802	8,170
Norway							91,000	133,350	170,750
926.0*	86%								
1,256.0	86%								
6,120.0	82%						128,000	198,000	164,000
4,000.0*	90%						7,284	8,082	9,045
23,400.0*	86%						1,994	2,216	2,617
Switzerland							0,616	0,700	0,871
129,098.3									
KNOWN TOTALS		18,231.0	18,653.2	18,671.6	21,138.1	23,328.4			
Extrapolated		22,625.0	21,945.0	21,967.0					
Zone 5: CENTRAL/SOUTH AMERICA									
6,957.0*	88%						292,670	984,000	3,184,000
465.0	93%						73,430	87,000	127,120(e)
1,495.0*	88%						70,280	88,870	112,280
113.0	84%						49,786	43,320	47,837
215.0	90%						67,385	94,410	116,458
3,190.0*	95%						199,000	170,900	237,000
184.0	70%						986,900	2376,830	6133,000
275.0*	85%						24,081	42,963	74,795
1,438.0	70%						4,300(f)	4,300(f)	4,300(f)
14,912.0									
KNOWN TOTALS		1,682.0	1,812.4	2,114.0	1,848.0	2,032.4			
Extrapolated		2,549.0	2,595.0	2,836.0					
Zone 6: SOUTH PACIFIC									
6,900.0*	86%						1,008	1,786	1,246
685.0*	89%						680,250	996,000	1077,889
na									
1,304.0	92%						1,285	1,540	2,131
New Zealand(g)							9,084	14,050	17,590
471.4	80%								
980.0	72%						2,108	2,138	3,189
630.0	82%						23,000	23,040	27,200
Thailand									
10,590.4									
KNOWN TOTALS		2,630.3	3,278.3	3,085.4	2,980.3	3,146.0			
Extrapolated		3,275.0	3,848.0	3,870.0					

Table 2 (continued)
1983-1985 world construction expenditures (\$000,000)

1/1/84 Equipped Lines	% in Serv		Current US\$ (a) versus IF 6% Increase in 1983 Constant US\$ (b)			IF Budgets Increased 6% Annually in Constant 1983 US\$ ^a			Monetary Units = US\$ 1		
			(a)			(b)					
			Spending in Current US\$			Constant 1983 US\$ ^a					
			1983	1984	1985	1984	1985		1983	1984	1985
Zone 8: FAR EAST											
1,870.0	83%	Hong Kong	82.9	96.0 ^a	110.0	91.1	100.2		6,490	7,799	7,826
50,288.0 ^a	85%	Japan	7,328.0	7,313.0	7,290.0 ^a	8,055.1	8,854.3		232,000	232,450	251,800
5,358.0	90%	Korea, Rep. (i)	1,309.0	1,309.0	1,309.0	1,438.9	1,561.6		747,850	800,150	829,500
5,386.0	72%	Taiwan	426.2	388.2	600.0	468.5	515.0		39,000	40,200	39,500
62,902.0		KNOWN TOTALS	9,146.1	9,106.2	9,309.0	10,053.6	11,051.1				
		Extrapolated	11,433.0	11,383.0	11,637.0						
Zone 9: MIDDLE EAST											
80.0 ^a	65%	Bahrain	22.0	24.0 ^a	25.4 ^a	24.8	27.3		0.381	0.376	0.377
1,542.2	70%	Iran	700.0 ^a	750.0 ^a	799.9	769.5	845.8		84,528	89,075	94,352
1,130.0	89%	Israel	200.0	170.0 ^a	150.0 ^a	219.8	241.7		33,730	110,250	663,000
344.0	60%	Kuwait	81.5	120.1	226.8	89.6	98.5		0.289	0.294	0.307
306.9	84%	Syria	44.6	37.7	47.6	49.0	53.9		6,289	7,140	7,880
2,188.0	85%	Turkey(j)	346.0	180.0 ^a	89.7	380.3	418.1		187,000	304,120	499,450
5,991.1		KNOWN TOTALS	1,394.7	1,291.8	1,349.4	1,533.0	1,685.3				
		Extrapolated	3,487.0	2,230.0	3,349.0						

^a assumes 3.7% annual inflation, based on 1984 increase in US GNP deflator

^a estimated by Telephony

na not applicable

(a) includes Puerto Rico Telephone

(b) development program underway projects 343,000 lines by 1987; 470,000 by 1993

(c) fiscal year, July-June

(d) capital expenditures as reported in prospectus for British Telecom

(e) official rate

(f) preferential rate for public sector debt and essential imports

(g) equipment expenditures only, fiscal (March 31) budget for 1984, 1985 and 1986

(h) PLIN lines increased to 471,367 as of 12/31/83 with consolidation of smaller

companies (i.e., Retelco, Fitelco, etc.)

(i) based on continuing commitment to \$6.5 billion program, assumes spending level

and allocations for inflation

(j) investment was 64.7 billion/TL in 1983, up from 37.1 billion/TL in 1982

resulted in a split rate: 4.3 bolivars to U.S. \$1.00 for public sector debt and essential imports; 7.5 bolivars, to normal imports and 12.6 bolivars, to luxury imports.

Sovereign nations indeed reserve and exercise the right to define terms and to concentrate on checking inflation or making an extraordinary effort to maintain growth. The following typical examples illustrate how this works out for telecommunications capital expenditures:

- Austria spent AS10.204 million (\$610.7 million) in 1983, AS10.927 million (\$561.1 million) in 1984 and estimates 1985 spending at AS12.435 million (\$588 million.) Six percent real growth would have required 1984 expenditures of AS13.072 million (\$671.3 million) and 1985 expenditures of AS16.437 million (\$737.6 million.)

- Telebras (Brazil) will maintain expenditures of \$850 million to \$900 million, although the cruzeiro fell from the 1983 rate of 252.670 per U.S. \$1.00 to 3184.0 per U.S. \$1.00 on the

first business day of 1985. Had Telebras failed to maintain a level of parity, its purchasing power would have fallen from \$908 million in 1983 to \$72 million in 1985.

- India's Rs26,550 billion program for 1980-1985 equals \$2.8 billion in 1983 dollars, \$2.5 billion in 1984 dollars and \$2.2 billion in 1985 dollars.

For most countries, concern over the health of current accounts has superseded wishful thinking, because deficits must be paid in foreign currency. And the options for generating foreign currency are few. For many developing countries, the main or only source of foreign currency is tourism, but there aren't enough tourists to go around.

For many countries, payments on rescheduled loans will constrain telecommunications spending plans for several years. The World Bank and other development agencies cannot offer salvation. Though the World Bank has never had a default, it enjoys a luxury not available to commercial lenders: No further loans are

given until outstanding loans are current. Money for development is, therefore, dependent on commercial lenders and supplier credits. And lenders are cautious, lest they become captive to the borrower.

Those who preside over the telecommunications networks of developing countries also are entering 1985 cautiously. The two factors that influence their telecommunications development, raw material prices and interest rates, are beyond their control.

Depressed earnings offer little hope that the extraction-based economy countries can do more than concentrate on their highest priority projects. Even Saudi Arabia, which has invested some \$5 billion in its network, will be taking a closer look at priorities as the need to develop non-oil dependent industrial sectors increases in importance.

Many major projects have been postponed and lower priority projects cancelled as the international debt

Continued on page 45

Table 3
Projected new and replacement
Lines 1986-1988

PROJECTED NEW & REPLACEMENT LINES 1986-88

	1986	1987	1988
KOREA	1,000,000	1,000,000	1,000,000
TAIWAN	491,000	535,000	550,000
THAILAND	318,000	445,400	302,600
	1,809,000	1,980,400	1,852,600

crisis continues to plague Latin America. At the height of the crisis, the Inter-American Development Bank estimates that total debt for 20 Latin American countries represented 202% of export revenues. Debt service was 53%. The traditional rule of thumb for manageable debt service was 20%. Telecommunications remains high on the development agenda as a support to expansion of the business sector but the fiscal squeeze is on. Brazil has had to divert funds to other sectors and installations have fallen from a peak of 1 million lines annually in the 1970s to about half this number. Chile, too, is hard-pressed to meet its goal of 622,000 lines over 1982-1989. Peru has reorganized its former government agency into a corporation with a mandate to operate as a com-

mercial enterprise. Costa Rica's network ranks among the best in the region: Installation of 50,000 digital lines began in 1984 and the goal is 5% average annual growth.

In Africa, the Republic of South Africa accounts for 43% of the continent's 8 million telephones; Egypt, Kenya, Libya, Morocco, Nigeria, Tunisia and Zimbabwe account for 80% of the remainder.

Falling oil prices interrupted Nigeria's plan to double to 290,000 the number of telephone lines. It has negotiated repayment of \$365 million of central office equipment purchases that began in the late 1970s. Payments will be spread over 6 years, with a 2-year grace period that began this year. The PTT does have a tentative agreement to purchase \$171 million of switching equipment. It hinges

on a loan guarantee by the export credit agency of Italy, where most of the equipment for Nigeria has been manufactured.

Morocco's allocation of \$250 million over the 1981-1985 period to achieve its goal of 3 lines per 100 inhabitants by 1990 seems low. But it is significant, given the region's situation. Telephone growth in South Africa has been constrained to 5% annually. It plans to double the trunk line infrastructure by 1988. About 70,000 subscribers were served by digital exchanges by the end of 1984 and teletex is being extended throughout the country.

Collectively, the least developed countries in Africa have approximately 500,000 telephones. Plans call for the number to increase to almost 4 million by the year 2000. Achieving this goal will require average expenditures of \$350 million annually through 1983-2000. Emphasis currently is on the interexchange network.

Botswana has on order a \$22.5 million digital telephone and radio network. Cameroon will install a \$3 million microwave link to establish a backbone trunk network between its southwest and northwest provinces. The Lome (Togo)-based Economic Community of West African States (ECOWAS) is nearing completion of its first major project, Intelcom I. Four links running from Ghana to Upper Volta, Benin to Upper Volta, Nigeria to Niger and Mali to the Ivory Coast, are expected to be in place this year. The \$45 million Intelcom II phase will link Senegal, Gambia, Guinea Bissau and Guinea. Establishing automatic telephone and telex links between the 16 capital cities of

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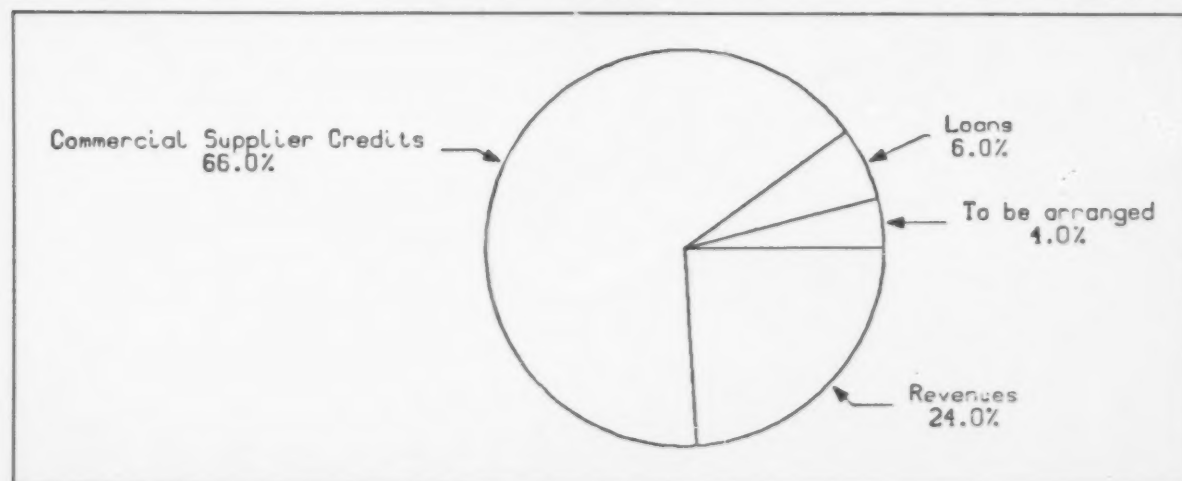


FIG. 2 Thailand's budget funding for 1986-1990 (U.S. \$1.630 billion).

'...funds generated by telecommunications may be diverted to other projects. The priorities in many countries are health and education, water and power utilities and roads.'

the ECOWAS member nations will improve business communications capability and toll revenues.

Toll networks represent a source of foreign currency as well as business communications capability. For example, Philippines Long Distance Telephone, which services the major share of the country's local network, generates 70% of its revenues from toll and 50% of toll from international calls. These dollar earnings help finance large scale projects.

However, funds generated by telecommunications may be diverted to other projects. The priorities in many countries are health and education, water and power utilities and roads. This, combined with tariff structures that do not cover the cost of basic service, does little to encourage the success of proposed self-help, rotating funds for telecommunications development. Such funds, which would be used when traditional sources such as the World Bank are unable to provide loans, would rely on repayment from the future profits of new systems.

The telecommunications problem of the high technology countries is free—or freer—trade. In the United States, the breakup of AT&T has opened up new opportunities for the major supplier-nations of Europe, Asia and North America. The regional Bell operating companies (RBOCs) and their parent organizations, the regional holding companies (RHCs), now are the largest open telecommunications markets in a world where few such markets are truly open to international trade. Naturally, the U.S. is pressuring its major trading partners—like Japan—to reciprocate.

All of the countries with mature telecommunications networks also have to come to terms with liberalization. The relentless pressure to do so comes mainly from the customer that cannot be ignored—the business users. They, of course, are the sources of the most revenue and profit for all carriers.

In the United Kingdom, for example, 300 corporations generate 45% of business user revenues in the country. Nor is the 20/80 rule, where 20% of the customer-base generates 80% of dollars, unique to Britain or the United States. The 900 firms that constitute West Germany's major business user group generate almost a third of the country's telecommunications revenues. These users are the movers and shakers of telecommunications demand.

The United Kingdom also is reaping the benefits of privatization—some \$4.7 billion from last year's sale of shares of British Telecom. The government retained 49.8% control of the company and will benefit from future profits and tax revenues. When it was wholly-owned by the government, British Telecom paid no taxes. This year's tax bite will be close to \$600 million. Revenues rose to \$4.1 billion, up 11% from \$3.8 billion the previous first-half. The sale also helped dispel a PTT concern that privatization might leave shares begging in the market. British Telecom's sale was so successful it attracted three times the amount of cash that could be accommodated.

Japan, now committed to the privatization of NTT and substantial liberalization, faces some harsh decisions as the largest national market in the combined Asia-Pacific region and the region's largest supplier. Nippon Telegraph and Telephone's (NTT) expenditures leveled at the Yen 1.7 trillion in 1980. Other countries in the region, such as Australia, Korea and Taiwan, have strong demand and the beginnings of competitive telecommunications manufacturing industries. Hong Kong and Singapore satisfy most of their requirements with imported technology. These two major service centers, however, have very sophisticated requirements and enviable bargaining positions.

The Philippines has embarked on an ambitious program to add 3 million lines to satisfy 100% of demand by the year 2000. The first phase of the program is underway in Metro Manila. Indonesia plans to add 750,000 lines to its network. Malaysia's \$254 million 5-year plan ends this year. But

the stars of the region are Korea, Thailand and Taiwan, which will add a total of 5,642,000 new lines over 1986-1988. (Table 3).

Taiwan's 25% annual growth rate in the 1970s has leveled out at 12%. The number of lines has increased from 1 million in 1975 to 5.3 million in 1984. 1986-1995 plans call for investment of \$2.5 billion (T\$100 billion) to cope with continuing strong voice demand and surging demand for data communications. Work has begun on realization of the country's ISDN.

Taiwan's development goals include increasing local switch digitization from 1% of 5.8 million lines in 1985 to 31% of the 7.3 million lines projected for 1990; all of the 10 million lines projected for the year 2000 will be digital. Current plans call for installing 400,000 new lines in 1985 and accelerating to 550,000 annually by 1990. Replacement lines will go from 34,000 in 1985 to 321,000 by 1990. By 1990, 82% of the toll switches and 88% of toll circuits will be digital, with 100% digitization by 1998. Approximately 44% of the local trunk circuits will be digital by 1990, with 100% digital capability by the year 2000.

The Korean Telecommunications Authority (KTA) is an outstanding success story. KTA recently began installing 1 million new lines annually, a pace it expects to maintain through 2001, the year it expects to have 22 million lines in service. The current network has 6.3 million lines compared with only 2 million lines in 1978. KTA's \$6.5 billion program is

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'Japan, now committed to the privatization of NTT and substantial liberalization, faces some harsh decisions as the largest national market in the combined Asia-Pacific region and the region's largest supplier.'

71% internally-funded; 54% derived from revenues with an additional 17% from revenues earned by tariff increases (Figure 1). It has national priority, investment will account for 7.5% of total government investment over 1982-1988. By comparison, telecommunications investment to total investment averages 3%-4% in continental Europe. Cellular mobile service was introduced in the Seoul area during 1984 and subscribers reached 2700 by the end of the year. Service is expected to be nationwide by 1991. Teletex and videotex will be introduced in 1986. Teletex will be in service with 7000 initial circuits, increasing to 152,000 by 1996 and 544,000 in 2001. Videotex service will increase from 2500 initial circuits to 32,000 by 1996 and 75,000 by 2001. DACOM, a subsidiary of KTA, began commercial data service in 1983 and began offering international electronic mail service in Korean and English during 1984. ISDN plans are underway and fiber optic routes are expected to cover 49% of the trunk network by 1991.

The Telephone Organization of Thailand's (TOT) network has grown to 620,000 lines, although only 50% of expressed demand has been satisfied. At the completion of its 3rd and 4th Telecommunications Project in 1986, digital penetration of switching and transmission facilities will be at the 50% level. The 5th Telecommunications Plans calls for expenditures of \$1.6 billion (Figure 2) over fiscal period of 1986-1990 and the addition of 1,066,000 new lines. New service plans include cellular, mobile service for 5000 subscribers by 1986 and a nationwide low speed data service using the public switched network. Videotex plans also are underway to serve some 1200 subscribers in Bangkok. Upon completion of the program, access lines will have increased from 1.69 to 2.71 per 100 inhabitants and the waiting time for new service will have been reduced to 72 months.

These "snapshots" of substantial telecommunications progress in spite of the problems are important: They are the brighter side of the struggle to stay even. And, in every case, progress is directly linked to the priority given telecommunications in a country's development plan. The message is clear: For years to come, telecommunications development will be measured not solely by how much money is available but by how purposefully and wisely available money is spent. □

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Telecom systems for small businesses have a bright future in Europe

The convergence of communications and computer technology, the efficiency telecommunications offers modern businesses and the trend toward liberalization bode well for the future of a long neglected market

BRIAN D. SIMMONS

INNOVATIVE developments in telecommunications most frequently relate to providing systems to meet the complex requirements of large businesses, characterized by the needs of multi-national corporations, the oil and gas industries, and large company groups. Small business needs are rarely either addressed or aided by the winds of change sweeping through communications. Yet, in reality, small business users represent by far the largest group of users, and are a healthy market that should not be ignored.

This situation applies in almost all European countries, but it is particularly applicable in some, such as the United Kingdom.

What are some of the developments which are influencing the situation now that the marriage between computers and telecommunications is really beginning to happen for the benefit of the hundreds of thousands of small businesses throughout Europe?

One significant feature of the telecommunications deregulation program underway in the United Kingdom has been the number of small businesses starting to market an innovative range of small electronic telecommunication systems to replace the often cumbersome and antiquated telephones, switching systems and telex machines currently in use. These companies are compet-

ing effectively with British Telecom (BT). Although BT holds the major market share of new systems—its successful Monarch private automatic branch exchange (PABX) has already sold more than 10,000 units—it is beginning to experience significant inroads in its traditional business lines.

The small PABXs, key systems and telex interface units and processor controlled telex terminals now available from the private sector are of particular interest to small businesses. There is tremendous scope for upgrading the installed base of small business systems.

In the U.K., there are a total of 1.8 million businesses, of which 85% are in the small business sector. Most telephone systems in this sector have fewer than four exchange lines. Out of the nation's 30 million lines, of which 20 million are in the private residential sector, only 10% are used by small businesses. Yet the actual number of key systems and basic

telephones, such as manager/secretary units, is more than 250,000 and there are 80,000 small PABXs.

Although not identical to the situation in the U.K., France, West Germany, Italy and most other European countries follow a similar pattern. Many of these systems are manual or pre-electronic, although over the last 3 years there has been an acceleration in the sales and rentals of replacement electronic systems.

There are fundamental differences between large and small companies in their needs and in the manner in which they organize themselves both to assess and to acquire new systems. Despite their small size and often modest requirements, small business telecommunication needs can be relatively complex and may require a good deal of investigation in order to arrive at an optimum solution. Yet, all too often, stock solutions are offered to service their needs. Each business has a unique

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Table 1
Small computers in Europe
(end of 1983)

	Commercial	Special	Home	Total (millions)
France	21%	11%	68%	0.53
West Germany	35%	20%	45%	0.48
Italy	26%	14%	60%	0.20
U.K.	8%	7%	85%	2.48

Brian D. Simmons is a Senior Consultant with PA Computers and Telecommunications, London, U.K.

set of requirements that should be addressed if disappointments are to be avoided when systems are in service.

How do the typical requirements of both large and small businesses compare?

Large business

Large businesses deal largely in volume communication requirements. These usually comprise large sophisticated PABXs, voice networks, message-switching telex centers and data networks linking terminals and microcomputers with minicomputers and mainframe computers. In addition, there are often specialized needs, such as facsimile, electronic mail, mobile radio, teleconferencing or videoconferencing, and possibly voice messaging. Increasingly, network management and call-cost control systems bring new methods to the way in which communications services are planned, implemented, operated and controlled. All this calls for an increasing budget, making communications one of the largest corporate costs. It also necessitates a qualified telecommunications manager, sometimes supported by a team of specialized staff, to operate the total service and to interface with the other highly important data processing and information technology groups within an organization.

Telecommunication managers will often be active in users' groups. In the U.K., for example, there is the Telecommunications Managers Assn. (TMA), which has 450 members drawn from the majority of the most important companies. Elsewhere in Europe, other user groups are being

of all that is taking place.

The small business sector bears little similarity to the large business sector. User awareness of what is available and how to plan for the future is generally not as great in the small business sector, although in some businesses there is now considerable management interest. Decisions on what to acquire, and on long term planning, are often either the domain of a lively director or one of the 101 tasks of an overworked and harassed office manager.

For the most part, requirements are basic: a telephone system or just one or two ordinary telephones, possibly a telex terminal or a facsimile machine, a telephone answering machine and perhaps a wide area paging device. Many small businesses, however, have only a telephone service.

The conservative tendency is to use only the products of the national telecommunications administration (PTT) rather than to branch out into private systems, although this generalization depends very much on the country concerned, and on the policy prevailing for private supply and

already installed in considerable numbers in many small businesses to perform accounts, ledger, stock control, appointments, calculations, filing, addressing and world processing—also will be used as a communications facility. The range of applications which will emerge include: telex, electronic mail, view-data, videotex, teletex, database access and software downloading.

In addition, with suitable programs, there will be further applications in electronic directory services, telephone call logging and cost control, and traffic monitoring. This range of uses should be well within the capability of the more intelligent personal computers now available.

Convergence

It is informative to compare the sizes of the small business computer and telecommunications markets in the European Economic Community (EEC) countries. The four largest countries are France, West Germany, Italy and the U.K.

The rate at which small computers, suitable for use by small businesses and at home, are being installed in Europe is staggering. For example, during 1983 60,000 IBM Personal Computers were sold and, by the end of 1984, well over 200,000 were expected to be in service. This phenomenal growth is expected to increase. The total number of small computers which cost less than \$5000 installed in these four countries reached 3.5 million by the end of 1983 and is now likely to be as high as 5 million with the major share being installed in the U.K. (Table 1).

As these computers are connected to telephone lines, the number of computer-based telecommunication transactions which take place will grow enormously. The high rate of penetration of telephone lines to almost all businesses and to many homes will mean that telematic ser-

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Table 2

Small PABXs and key systems in Europe

	PABXs (as many as 30 lines)	Key systems (all types)
France	60,000	470,000
West Germany	90,000	260,000
Italy	45,000	510,000
U.K.	80,000	280,000

'The small business sector bears little similarity to the large business sector. User awareness . . . is generally not as great in the small business sector. . . .'

formed, many affiliated with the International Telecommunications Users' Group (INTUG).

The value of users' groups, both to represent users' interests and to educate and inform members, has been of particular benefit in the U.K. where fast moving legislative measures, changing environment and rapid market movements have put extra pressure on users to keep abreast with the details and the consequences

maintenance of apparatus, in addition to the PTT's offerings.

Future needs

Perhaps it is inappropriate to look only at the traditional situation, because big changes are occurring in the way small businesses use technology. If, therefore, a scenario about what is likely to be required in 3 to 5 years is developed, the vista opens up considerably. The microcomputer—

vices can come into vogue at little extra cost, because the installation of a central office line has already been achieved. The prospect of considerably increased business from the domestic sector should generate extra revenues for the PTTs and network operators from what is traditionally a low call-volume market.

There are far fewer telephone switching systems than there are computers, but PBXs and key systems are generally more expensive and generate far more traffic and revenue. Indeed, it is confidently pre-

growth of small businesses both to provide and consume new products. As computers penetrate further into the home to satisfy basic business needs, as well as entertainment games and educational applications, it is probable that a new trend in data communications will emerge in which residential subscribers will choose to access local shops and mail order stores, banks, building societies, insurance offices, libraries and information services, using a range of terminals.

This development could well mark

formance telephone selling. Efficiency will be the key, and calls will be automatically generated according to a program for the day. As each call materializes, information pertinent to the called person or business will be shown on a visual display unit. This information should include type of business, product or service interest, last order data and payments outstanding. This method of telephone selling can save time spent hunting through correspondence and files, and should increase productivity substantially.

Small business functions of this type should increase with the combined facility of stored program control telephone systems and personal computers.

The integrated digital services network (ISDN) increasingly interests big users, many of which are in an advanced stage of planning their applications to use the ISDN when it becomes available. The prospect of being able to communicate using the main services of voice, data, text and image over a single 144 kilobit per second (kb/s) access line will be attractive. Such a service will offer co-incident transmission of several communication services.

However, the ISDN also will pose a number of problems for small businesses and adequate solutions will be required. For example:

- It may not be good strategy to put all services over one facility in the possible event of its failure.
- Present techniques for local ISDN access limit line length to about 4 kilometers and many small businesses are in remote locations.
- Most small businesses operate call connect systems and data services which use analog devices which are not directly compatible with the ISDN.
- ISDN is more cost effective for large PABX users via 2 megabit per second multichannel links than for small business users requiring only single lines.

Nevertheless, as more cost effective digital terminals are developed, a growing number of small businesses will migrate to digital operation and reap the benefits of the ISDN. In the event of line outages, wideband cellular radio digital links possibly could provide emergency service for a user until the wired link can be restored.

Most European countries now have advanced plans for the ISDN and, by the late 1980s, they should be bringing these into widespread opera-

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Table 3
Employed population

	Agriculture	Industry	Other	Total population (In millions)
France	3.5%	14.0%	22.0%	54
West Germany	2.0%	18.0%	21.1%	62
Italy	4.7%	13.5%	17.5%	57
U.K.	1.0%	15.0%	26.0%	56

dicted by all telephone administrations that, despite the big increases expected in non-voice services in the future, telephone voice traffic will remain the biggest revenue earner. The estimated installed base of small PABXs with capacities of as many as 30 extension lines, along with key systems, is shown in Table 2.

It is also interesting to compare the employment characteristics in these countries to get some indication of where the principal number of small businesses may lie. Table 3 shows the total working population of each in 1981, and the percentages of persons employed in agriculture, industry and other occupations which mainly comprise the service sector. The U.K. has the greatest percentage of people employed in the service sector, which includes shops, agencies, garages, builders, solicitors, decorators, travel, restaurants, small garages, hotels and guest houses.

The liberalized telecommunication industry in the U.K. is gearing up to service this market. Already more than 30 small key systems and PABXs have undergone the stringent type approval tests to qualify for connection to the public switched network in competition with BT.

It is expected that the further growth of service industries, together with an expanded innovative electronics market, will stimulate the

another step toward what is commonly referred to as the cottage industry era, but one in which only professional staff and home worker employment will probably have an impact.

The surge forward in information services also will widen the range of switching systems used. Automatic call distribution (ACD) systems will become increasingly popular; using ACD systems, a small group of persons will be able to service a large number of telephone callers on a programmed basis, using complex computer-aided telephone terminals, for taking enquiries, orders and bookings. Likewise, almost the reverse of this process will occur in which a small team of persons, using sophisticated database telecommunication terminals, will be engaged in high per-

'... It will be necessary for industry and PTTs to increase the... awareness of their potential users....'

tion. On the assumption that in the future there could be a much greater number of residential customers who use communications services to contact small businesses for tele-enquiry, tele-shopping and similar services, there could be a big increase in the volume of generated traffic. If ISDN service can be cost effectively used by residential subscribers, who form by far the largest single user group, although at present they are a very low traffic volume group, there could be a great surge in demand and revenue from these applications.

Alarm and security services are increasingly required by small businesses and homes. The ISDN can offer particularly secure service, as well as the prospect of slow-scan full 625 line TV screen quality. A 64 kb/s channel will enable screen replenishment at 4 second time intervals, which is adequate for most closed-circuit television services.

The low visibility which small business telecommunications generally has belies the true extent of this important market and its needs. Every small business has a unique set of communication requirements which must be satisfied effectively in order to achieve the best possible price-per-

formance relationship.

However, the arrival of the low cost computer and an exciting portfolio of microprocessor controlled telecommunications terminals is dramatically altering this situation, particularly in the U.K., where deregulation is increasing the range of new systems on the market and the awareness of BT about the needs of the small business.

To continue this penetration, however, it will be necessary for industry and the PTTs to increase the education and awareness of their potential users, particularly people who still use old technology equipment to conduct their businesses. Similarly, users must be prepared to set aside time to discover what is available, and to plan more effectively for their future telecommunication requirements. All too often, the pressures of modern business mean that only a small proportion of business managers devote time to this task or belong to user groups which represent their business needs.

Failure to keep abreast of developments may jeopardize the essential expertise necessary to stay ahead in an increasingly competitive business world. □

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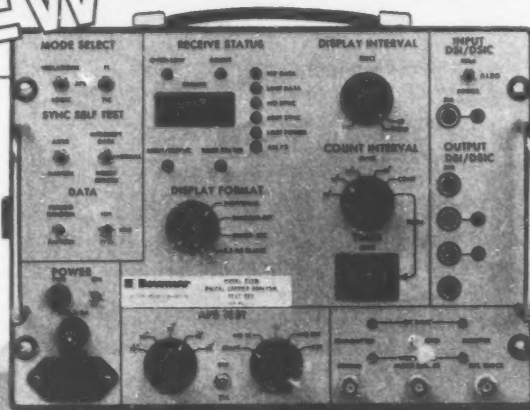
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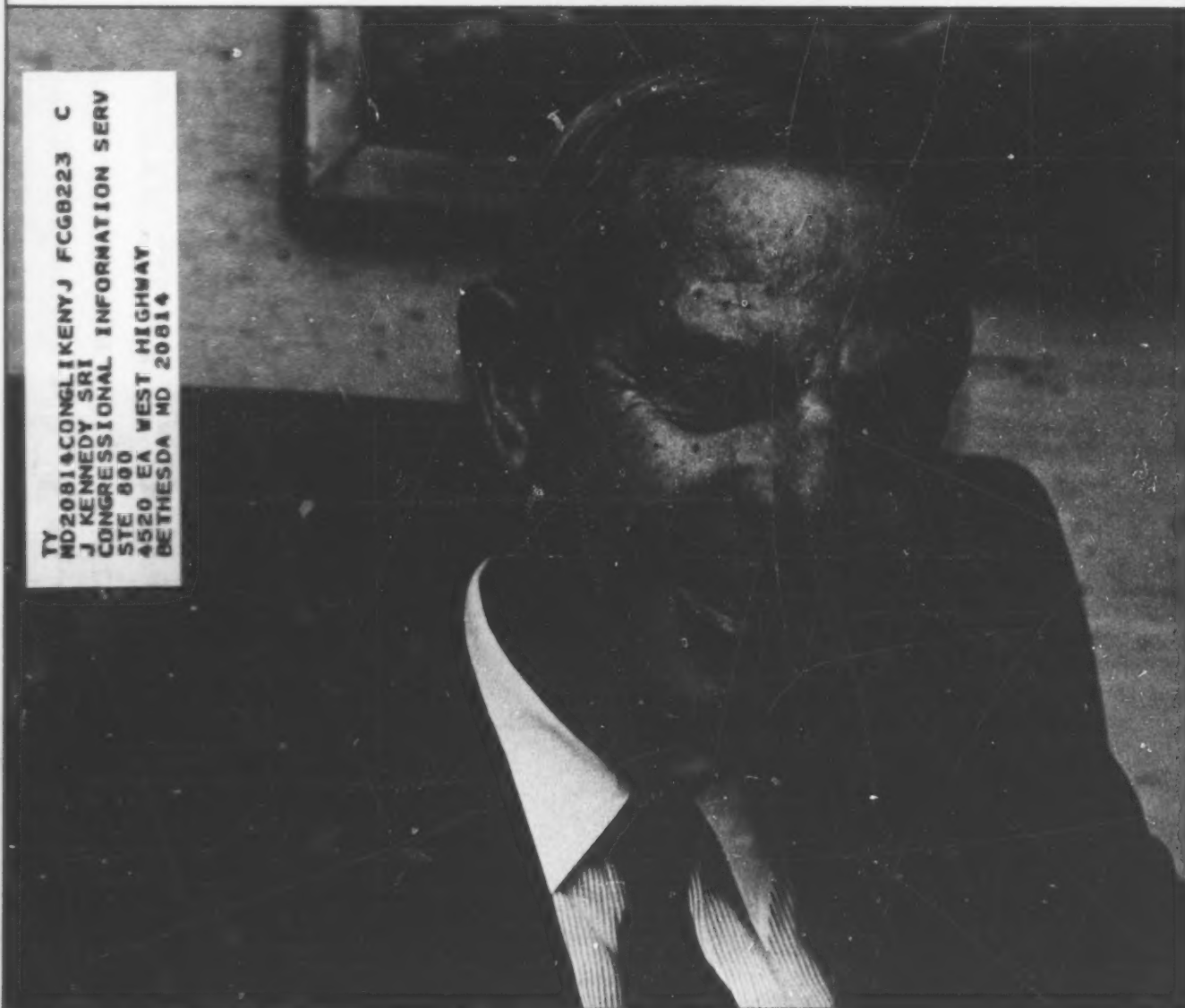
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The interexchange carriers: the view from Wall Street

ROGER P. FAVALE

HOW DOES the financial community currently view the interexchange industry?

First, it is important to provide some definition of the industry and its numerous participants within it. It is important to review the size of the market as it is currently defined and to focus on the factors that will provide the impetus for continued growth. It also is necessary to evaluate the impact that competing communications technologies may have on the long distance market and then to try to determine the opportunities that may eventually present themselves to companies and investors.

The financial community believes the long distance market will continue to grow. It is a market which will hold opportunity for companies to provide a variety of telecommunications services and to manufacture a broad array of carrier and end user equipment. However, the number of companies involved in the interexchange industry has grown dramatically over the last few years. Competition in both the service end as well as the manufacturing end of

the business is expected to be fierce. This intense competition may limit access to the capital markets to those companies that can demonstrate an above average management and marketing capability, and a good deal of financial staying power. Bankers and investors are becoming increasingly cognizant of the competition among companies and between technologies, and are becoming more and more selective in their investments.

Background

Of course, before 1984 all telephone service, both local and long distance, was provided by American Telephone & Telegraph Co. (AT&T) and the Bell System. Even though there were several strong and rapidly growing Independent telephone companies, the dominant Bell system accounted for the vast majority of telephones in place and for almost all of the long distance market.

In the 1970s, with the encouragement of the Federal Communications Commission (FCC), which favored competition in the long distance market, and with the support of the Dept. of Justice (DOJ), which believed that a monopoly should not be maintained solely for monopoly's sake, other

common carriers (OCCs) proceeded to expand their networks and to develop a multibillion dollar business. Although OCCs were able to capture a measurable portion of the long distance market, AT&T, with its massive network, continued its market dominance and maintained a 95% share of the business despite the market's extremely rapid growth.

During the next few years, many smaller companies, which today are referred to as resellers, developed another market segment by renting various wide area telecommunications service (WATS) and foreign exchange (FX) lines in bulk from AT&T and then selling them retail to end users at discounts of 25% to 40% to AT&T's direct distance dial (DDD) prices. The more adequately funded and well managed resellers were successful in attracting subscribers and in generating revenues. Some of them attempted at great expense to construct their own transmission facilities to alleviate their dependence upon other carriers for transmission capacity. Others, however, found access to the venture capital community and the capital markets extremely difficult and, as one alter-

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Roger P. Favale is Vice President of Kidder, Peabody & Co., New York.

native, began to consolidate their efforts regionally with other carriers and resellers. One other option that some resellers pursued was to form joint ventures with larger, more established corporations to provide them with the financial and technical strength that the resellers lacked. The trend toward consolidation among resellers which began about 2 years ago is expected to continue as the former entrepreneurial nature of the resale business gives way to major corporate undertakings.

A commodity

The long distance market is a commodity business. It requires a major pooling of financial, technical, managerial and marketing resources within a company to ensure continued growth and profitability. While margins are very low, companies with good market share and efficiently used backbone systems should be able to do well. There are some concerns, however, about the future of a good number of resellers, especially those which are totally facilities-dependent. Increasing costs and price competition are making small resale operations increasingly uneconomic.

However, some of these resellers may be able to play an important role in the future. A fair amount of synergy is being developed between select resellers and operators of newly constructed satellite or fiber optics based networks. These resellers can become local traffic collection entities. Their knowledge of and marketing abilities within their areas of operation can play an important role in increasing the capacity utilization of many of these newly constructed networks, and this interaction will continue and will be mutually beneficial to both parties.

On the equipment side of the business, there are a growing number of mergers and joint ventures among manufacturers, which indicates that a consolidation is also underway in this segment of the industry.

The statistics

As of December 1984, the size of the inter-LATA (local access and transport area) market was approximately \$40 billion. At the end of 1984, AT&T reported inter-LATA revenues of approximately \$35 billion which represents approximately 88% of the inter-LATA market's revenues but only about 85% of total traffic. The OCCs have done an outstanding job in skimming the market and in capturing 15%

of the traffic. The OCCs will be able to continue to increase market share in the near term but they will find it more difficult to do so in the long term as AT&T takes steps to hold on to its highest volume customers.

While the market's traffic grew about 9% in 1984, AT&T is currently projecting that long distance voice transmissions will grow by 10% per year and data transmissions by 15% to 20%. A general consensus among the industry's analysts indicates that by 1990, total inter-LATA revenues will grow to the \$60 billion to \$70 billion range, depending upon whether a 9% or a 12% growth rate is assumed, and that AT&T's share of the market will settle down in the 70% to 75% range. A recent Arthur D. Little study projects that approximately 20% of the 1990 market will come from the data communications area. This rapid growth in long distance transmissions will be largely attributable to the anticipated decline in long distance prices.

In addition, the interexchange market, as currently defined, may be broadened to include the long distance or toll portion of the intra-LATA market. Various state regulatory agencies currently are undertaking studies to determine whether the intra-LATA toll market should be opened to competition. At the end of 1984, the Bell operating companies (BOCs) reported intra-LATA toll revenues of approximately \$9.9 billion and, with a conservative projection of 6.5% annual growth, this market segment alone could add about \$14 billion in revenues to the overall long distance market by 1990. This can only enhance the attractiveness of the market to participants and increase opportunities within it.

Access charges

The access charges which the long distance carriers now are paying to

local telephone companies are subsidizing local telco operations. There is regulatory and political uncertainty about how this situation will ultimately be resolved. Opportunities will vary depending on the outcome and the timeframe within which new access charges are implemented. Given an accelerated phase-in of access charges, a dramatic decline in long distance prices, which should bring about a major increase in long distance usage, is anticipated. This scenario would provide an impetus to major carriers to accelerate the installation of fiber optic and microwave transmission facilities, and additional switching equipment.

Manufacturers of such equipment and of fiber optic related electronics equipment would be major beneficiaries, as would producers of data communications and end user equipment, since rapid network development and inexpensive data transmission capacity will stimulate the computer area. On the other hand, given a protracted phasing-in of the proposed access charges, development in the long distance public network may be slowed and a good deal of the traffic growth may be accommodated by increases in service bypass facilities and private networks.

Proposed changes in the tax code may adversely impact upon corporate plans for network development as well as investors' appetites for capital intensive projects. The elimination of the investment tax credit would be viewed as an important negative factor for the industry since corporations and investors may be reluctant to commit large sums of money for the construction of these networks without tax benefits.

The players

Looking at the service side of the business, there are an incredibly larger number of industry participants today than there were 10 or even 5 years ago when AT&T was basically synonymous with long distance services. The sheer number of players has not only created some confusion in the minds of end users, it has forced bankers and investors to take a much harder look at individual companies, their products and capabilities, and their long term staying power. How do bankers and investors currently view the industry's composition?

First, they see the category of companies called OCCs, which, according to the FCC, is made up of specialized common carriers (SCCs)

Table 1	
Airnet	20.4%
U.S. Telephone	18.8
TDX	12.9
Starnet	7.9
Landtel	5.3
Network 1	4.6
Telephones	4.4
Teltec	4.3
Satnet	3.6
LDX	2.8
Southland	2.1
All others	12.9
Total	100

and miscellaneous common carriers. The SCCs are non-telephone companies authorized to provide domestic point-to-point communications services on a common carrier basis. They include such companies as MCI, GTE Sprint, U.S. Transmission Systems, Western Union, Satellite Business Systems, RCA Globecom and American Satellite. The FCC also lists 52 miscellaneous common carriers, which are companies with terrestrial microwave facilities used principally for radio and television transmission services. However, while the miscellaneous common carriers are not directly engaged in providing telephone services, their transmission facilities are leased from time to time by the SCCs as active or back-up transmission facilities.

Next are the Independent telephone companies which, unlike the BOCs, have virtually no restrictions on their interexchange market activities. All of the major Independents—including GTE, United Telecom, Continental, Centel, Alltel and Rochester Tel—already are competing or are planning to compete for some share of this lucrative market as evidenced, in part, by some of their recently announced fiber optics programs and their satellite-based investments.

Then there is the reseller segment. By last tally, the FCC had file numbers for 327 resellers, some of which were totally facilities-dependent while others had either in-place or under construction some type of backbone system. At the end of 1983, the size of the resale market was estimated to be about \$700 million. The leaders in the business, together with their approximate market shares are shown in Table I.

During 1984, a number of resellers either banded together or merged with Independent telcos that already had long distance facilities in place. To cite a few examples; U.S. Telephone became part of United Telecommunications, and Lexitel and LDX agreed to merge. There also was a consolidation of business among American Network (a majority-owned subsidiary of Pacific Telecom), Savenet and CP National's long distance operation. Advanced Telecommunications merged with TA Communications.

This trend will continue as resellers look for merger and acquisition partners to provide the missing elements that are absolutely necessary for long term survivability and profitability.

Economies of scale are an important consideration today for many of these smaller companies.

Coming into the ring

Major corporations also are entering various niches of the long distance market. Eastman Kodak recently announced its intention to offer value added data networking capacity on its own excess internal facilities. General Motors (GM) recently announced that it will probably enter the telecommunications field. GM has one of the biggest telecommunications networks in the world now and, with the acquisition of Electronic Data Systems and its network, it has excess capacity. General Electric Information Services is continuing its push into the enhanced telecommunications market with a new point-to-multipoint transmission service using frequency modulation (FM) subcarriers to transmit and a value added network to receive data traffic between host and remote computers.

Other corporations are either focusing on specific niche services or are concentrating their efforts in select geographic areas. One example is Argo Communications, which has put together a 12-city satellite-based switched digital network specifically targeted for business voice, data and videoconferencing services. The company also expects to be able to compete effectively in the private line market, to provide transmission capacity for resellers in its service cities, and to link its United States customers with the United Kingdom, France and Spain. Centel, France Cables and Radio, Alltel, M/A-Com, and California Microwave are major investors in this effort. Sears Roebuck, through a subsidiary, is moving ahead with a 26 city videoconferencing network using American Satellite's transponders.

There are also many small to medium sized public manufacturing companies and many small, private, venture capital backed companies addressing specific niches of the long distance communications market. For instance, Equatorial Communications, a small public company, is now offering micro earth stations to corporations that want to set up their own low speed point-to-multipoint data communications networks, which is a cost effective system compared to leased phone lines. Equatorial Communications also has recently announced the purchase of 11 Galaxy III transponders from

Hughes Communications; Hughes also will provide Equatorial Communications with access to its terrestrial networks which include earth stations and microwave facilities in New York, Los Angeles, San Francisco, Atlanta, Dallas and Chicago. Private Satellite Network is a private company which is trying to develop a niche business. It has been pioneering the use of small antennas for setting up video and teleconferencing networks. The list of small niche companies just goes on and on.

Furthermore, over the last few years there has been a proliferation on Wall Street of business plans for numerous satellite and satellite-based projects, all basically proposing to increase communications carrying capacity. Proposals have been reviewed for satellites operating in the C-band as well as the Ku-band. There have been proposals for high-powered direct broadcast satellites and lower powered ones for thin route services.

However, all of these proposals require huge investments and long lead times for implementation and, therefore, carry a great risk of misjudging market demand. Many investors and corporations have learned from past experiences that projecting market demand several years out and then implementing a plan to capture it is quite difficult, especially in an industry known for rapid technological change.

In the satellite area, for instance, the anticipated demand for transponders over the last few years has not kept pace with available capacity, and now earthbound technologies are capturing more of the markets which satellites were originally expected to handle. Today, some investors are beginning to re-evaluate the role that satellites will play in long distance communications. Although they are ideally suited for providing telephone service to hard to reach places and though they may still be more economical than the proposed fiber cables for transoceanic links, the tremendous advances in fiber optics may provide an economic alternative to satellites in certain instances.

Fiber optics transmission is of tremendous importance to the long distance industry.

AT&T and MCI, the two major long distance carriers, are the largest players in the fiber optics transmission market. Both companies, however, anticipate using fiber optics systems in conjunction with other

Continued on page 40

available technologies to maintain and enhance their networks. In addition to AT&T and MCI, at least eight other companies have announced plans to construct major fiber optics networks, albeit much smaller in scope than the one being built by AT&T. All of these announced networks are similar in terms of features and capabilities, and all propose to offer flawless, high capacity, low cost, digital transmission. However, as these projects attempt to make the transition from blueprint to implementation, only a few will actually be successfully completed.

The companies that have announced major fiber optics programs so far include:

- LDX has announced a 1600 mile network serving the Mississippi River valley and Texas. Kansas City Southern has provided the right-of-way and is a major investor.

- Litel plans to build a 1700 mile network serving the Midwestern and Great Lakes Region. Its first link was established in October 1984. Alltel, Centel, and Pirelli Cable are 32%, 28% and 20% owners, respectively, of LCI Communications, the parent company of Litel.

- RCI plans a 3250 mile network along the Conrail system connecting upstate New York to a 10-state area in the Midwest and using microwave facilities to extend the network into New York City. RCI is a subsidiary of Rochester (N.Y.) Telephone Corp.

- Elektra has announced plans to build a 550 mile network in Texas with a contemplated extension to Chicago. Elektra is a joint venture between Cable and Wireless and the Missouri, Kansas, and Texas Railroad. Its primary marketing focus will be on resellers.

- Fibertrak has announced an 8000 mile carrier's carrier network serving 53 cities which is expected to be completed by 1987. This ambitious program is a \$1 billion joint venture between the Santa Fe-Southern Pacific Corp. and Norfolk Southern Corp., two of the nation's largest railroads.

- Microtel is a regional network currently serving portions of the Florida market. The Norfolk Southern Railroad and Centel are major investors in Microtel.

- Lightnet plans to build a 5000 mile network using CSX right-of-way and serving 24 eastern states. Lightnet is planning to sell its circuits on a condominium basis; in other words, the customer will own the circuits but Lightnet will retain management re-

sponsibilities. Lightnet is a subsidiary of Southern New England Telephone, a company in which United Telecom owns a 10% share. (Incidentally, United Telecom is also proposing to construct its own fiber optics network.)

- UTCI plans to build a 23,000 mile network linking every LATA nationwide at a currently projected cost of \$4 billion. UTCI is a subsidiary of United Telecom. Unlike the other companies, UTCI has the advantage of being able to sell capacity directly within its own organization to U.S. Telephone, which serves residential and smaller business customers, Uninet, which serves corporations and large database operators, and Isacom, which serves larger corporate customers. [For more information on United Telecom's plans in the long distance market, see the interview with Chairman Paul Henson on p. 26.]

In January, as part of the trend toward consolidation within various niches of the industry, four regional long distance fiber optic network developers reached agreement to interconnect their networks and undertake a joint procurement and marketing effort.

This group, currently called the National Telecommunications Network (NTN), includes Microtel, Southern Net, Litel, Southland Communications and LDX. It is expected to provide service to most of the country east of the Mississippi River, with the exception of Northeast, which will be handled by RCI. RCI has agreed to interconnect with the STN but declined to join the organization.

Risks

From Wall Street's perspective, despite the relatively high growth rate anticipated for the long distance market, questions are beginning to be raised about the possibility of long distance transmission overcapacity if a majority of the announced systems are actually completed. Investors also are voicing other concerns. First, since all of these companies intend to use single mode fibers, which have virtually no bandwidth limitations, further system capacity will only be limited by available electronics at the terminal points and not by cable addition or replacement. Second, the scheduled increases in the number of satellite transponders over the next several years will further exacerbate the overcapacity situation. Since the bulk of the

proposed fiber optics facilities are expected to be completed in 1986, the competition to provide long distance services will greatly intensify.

Investors' concerns will have a direct impact upon the availability of risk capital for at least some of these projects. They will also reduce the likelihood that major system users will enter into long term contracts with the carriers, since overcapacity should eventually produce lower prices. Finally, it may become increasingly difficult for companies to obtain suitable financing for their proposed long distance projects.

Thus, in summary, the long distance telecommunications industry is expected to grow very rapidly and should provide ample opportunities for both service companies and manufacturing companies. As equal access is implemented, there will be a brief window of opportunity for market participants to court subscribers and increase market share. The inter-exchange industry will continue to be capital intensive and can be expected to be fiercely competitive. This keen competition will probably continue into the late 1980s, and will result in an increase in marketing and operating expenses for its participants as they strive to gain market share. Therefore, a fair amount of pressure on operating margins and profits can be anticipated.

The need for capital will increase as carriers construct new or augment older transmission facilities. In all likelihood, there will be an increasing reliance on debt financings which may strain the balance sheets of weaker companies. Financial strength will be a key element for survival. Companies may need longer investment horizons and will need staying power to be able to wait for market demand to materialize.

While overcapacity may present some problems for the carriers, it may give enterprising resellers some breathing room. Well established customer bases and efficient use of new and existing networks will become increasingly important. Company managements will have to be able to respond quickly to rapidly changing economic conditions, political pressures, market demands and regulatory developments.

Smaller companies will, of necessity, have to diversify and expand the scope of their services. The trend toward regionalization, consolidation and joint ventures among carriers, resellers and equipment manufacturers will continue. □

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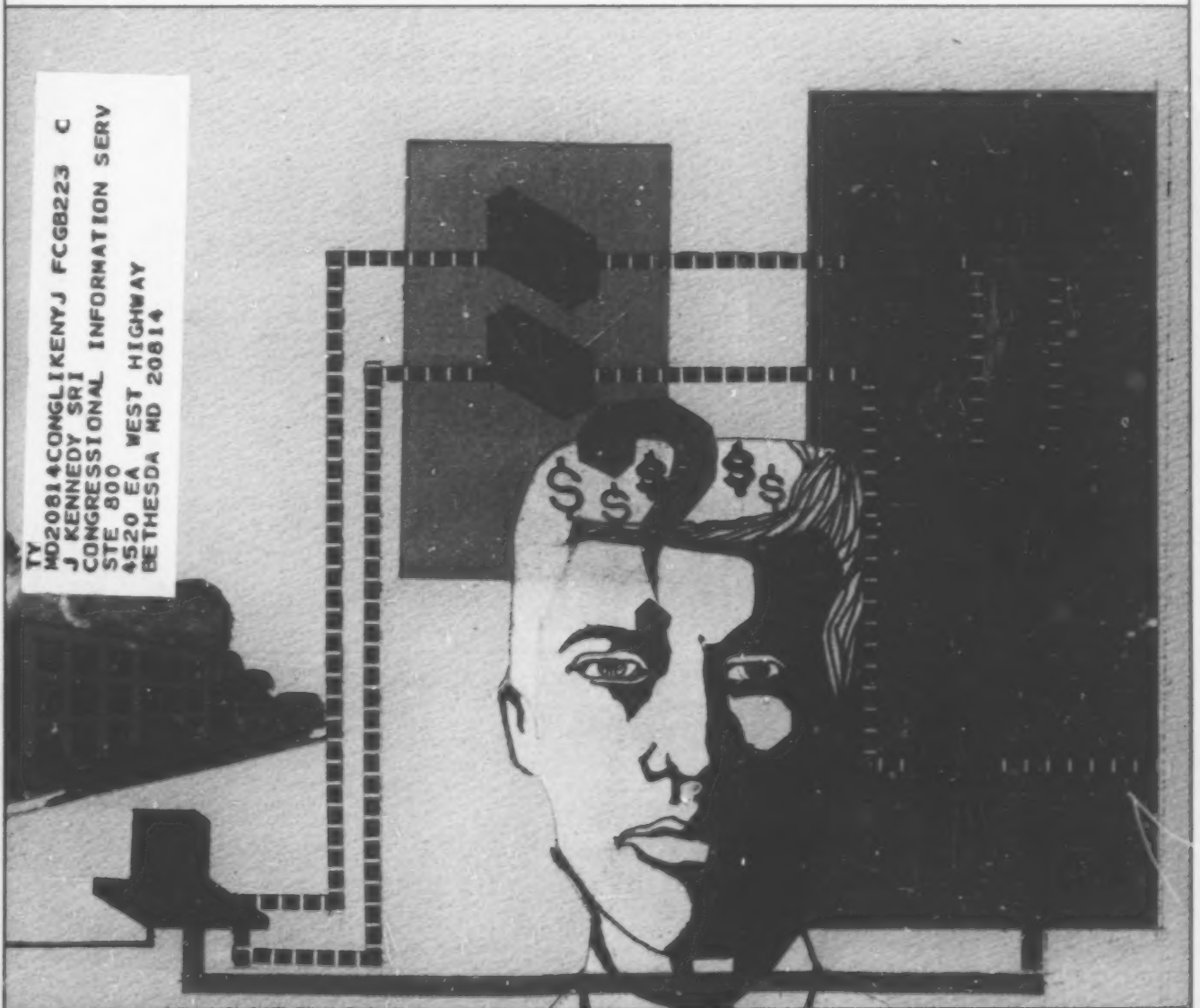
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International survey compares telecom costs around the world

THIS YEAR'S international survey on telecommunications costs conducted by National Utility Service (NUS), New York, during the period Jan. 11, 1984, to Jan. 11, 1985, reveals that U.S. rates for long distance telephone service declined by an average of 5.9%, to \$1.28 per 3 minute call.

NUS attributes this decline to the new competitive environment following the end of the Bell System monopoly, but cautions that prices alone are not a reliable indicator of industry trends, especially when it comes to choosing a long distance carrier.

With more than 400 ways to make a

long distance telephone call, at prices that vary by as much as 2000%, the moderate price decline recorded in this year's survey has not had a significant effect on ultimate user costs. A knowledge of when, where and how many calls are made, and an understanding of how this information compares to available rates, by monthly audits, is the only sound method a business has to ensure that a carrier is the most cost effective for its needs. This is a task not easily done, but it is the only reliable method.

NUS points out that in choosing a

long distance carrier, price is only one element of the equation and not necessarily the most important one. Before equal access, private long distance carriers were granted a discount on connection fees to local Bell operating companies. With equal access, these companies lose that discount at the same time they will be subject to other cost pressures such as network expansion and high marketing expenses, and the recent price decline may be the calm before a very competitive storm that likely will increase prices in the near future.

Other survey results for the U.S.

Table 1
International telephone/telex cost comparison — January 1985 vs. 1984
(National Utility Service, Inc.)

Country	U.S.	France	U.K.	Canada	Italy	FDR	Belgium
Annual inflation rate	3.0%	6.8%	4.9%	4.0%	10.5%	2.0%	5.7%
Local telephone							
1984	0.071	0.056	0.098	0	0.053	0.073	0.078
1985	0.071	0.077	0.105	0	0.066	0.073	0.078
Change (%)	0%	+37.5%	+7.1%	0%	+24.5%	0%	0%
Long distance telephone							
1984	\$1.35	\$0.85	\$0.59	\$1.43	\$0.74	\$1.09	\$0.35
1985	1.28	1.16	0.51	1.46	0.85	1.09	0.35
Change (%)	-5.9%	+36.4%	-13.5%	+2.1%	+15.0%	0%	0%
International telephone							
1984	4.60	4.10	1.85	4.52	5.36	6.97	5.70
1985	4.72	4.00	2.05	4.52	5.77	6.97	5.70
Change (%)	+2.6%	-2.4%	+10.8%	0%	+7.6%	0%	0%
Local telex							
1984	1.03	0.30	0.10	0.42	0.25	0.38	0.21
1985	1.14	0.33	0.11	0.43	0.28	0.38	0.21
Change (%)	+10.7%	+10.0%	+10.0%	+2.4%	+12.0%	0%	0%
International telex							
1984	4.44	2.48	1.78	5.08	3.73	3.13	3.84
1985	4.44	2.48	1.78	5.08	4.11	3.13	3.84
Change (%)	0%	0%	0%	0%	+10.1%	0%	0%

All prices based on a 3 minute call.

show that rates for local service were unchanged for international telephone and local telex rose by 2.6% and 10.7%, respectively, while international telex rates remained steady at \$4.44 per 3 minute call.

Among the European Economic Community (EEC) industrialized nations, France recorded the largest price increases. Local call rates were up 37.5% and long distance rates were up 36.4%. Local telex rates increased by 10.0%, although international telex rates were unchanged. International telephone charges declined by 2.4% to \$4.00 per 3 minute call.

The huge increases in local and long distance rates have been injected into the French political arena, with some politicians claiming that the government is using the profits from the national telecommunications administration to subsidize tax cuts promised for 1985.

In the U.K., local call charges increased by 7.1% to 0.11¢ per 3 minute call and are the most expensive of the surveyed countries. International telephone charges also rose, by 10.8% to \$2.05 per 3 minute call, but are the lowest international rates in the survey. British subscribers have the cheapest international charges and the highest local charges among the industrialized nations. This is bad news for consumers, because some 70% of telephone usage in Britain consists of local calls.

—Long distance telephone rates declined by 13.5%, to \$0.51 per 3 minute call, a move that reflects the apprehension of British Telecom (BT) over the threat of imminent competition from Mercury Communications, the only competitor of BT. Local telex rates also increased by 10.0%, while international telex rates were unchanged at \$1.78 per 3 minute call, the lowest such rates in the survey.

Canadian local telephone call charges are the cheapest; in fact, they are free. However, Canada is expected to begin levying local call charges in the future, perhaps even in the near future, to keep international rate increases to a minimum. International rates, currently at \$4.52 per 3 minute call, were unchanged in the survey year.

Local telex rates rose by 2.4%, although international telex rates were unchanged. However, at \$5.08 per 3 minute call, they are the highest in the survey. Long distance telephone rates increased by 2.1%, to \$1.46 per 3 minute call. This figure was again

the highest in the survey.

Local telephone call charges in Italy increased by 24.5%, but except for Canada, are the lowest in the countries surveyed. Long distance telephone rates rose by 15.0%, to \$0.85 per 3 minute call. International telephone rates in Italy rose by 7.6%, the second highest percentage increase after the U.K. Local and international telex rates rose by 12.0% and 10.1%, respectively.

The Federal Republic of Germany has the highest international telephone service rates among the sur-

veyed nations, at \$6.97 per 3 minute call, although no increases were recorded in the survey year. No other changes were recorded.

Long distance telephone charges in Belgium were unchanged at \$0.35 per 3 minute call, and are the lowest such rates in the survey. No other changes were recorded.

The NUS International Survey on Telecommunications Costs is conducted annually and is based on prices actually paid by the company's clients at 750,000 business locations around the world. □

DIGITECH

SPECIAL REPORT N^o 2

Equal Access: The Technical Aspects

Since the divestiture of AT&T, knowing exactly "what goes on" behind the dial of a telephone is vital to a company's successful conversion to equal access.

The technical ramifications and concepts involved with the connection to the trunk side of a central office are complex and raise many important questions: Can you convert to equal access without disposing of in-place equipment? If so, can you economically convert from line side access (Feature Group A) to trunk side access (Feature Group B or D)? Or can any system effectively handle the automatic number identification, the various sets of signaling protocols and the classes of service?

Digitech Communications has addressed these questions — and the technical problems they generate — with the development of the EAS-40 Equal Access System. The EAS-40 enhances an existing Interchange Carrier's (IC) switch to

accept Feature Group D protocols *without* modification to the switch — or the billing system. The EAS-40 also converts a nonconforming central office into a conforming central office by allowing it to offer Feature Group D trunks to IC's.

Digitech is pleased to offer the second in a series of informative reports prepared by our experts on equal access. This second report, providing clear definitions of techniques and concepts on trunk side access, is now available at no charge. Special report No. 1 provided background information on equal access and is still available. To receive your free copy, simply check our number on the reader service card or call, toll free: 1-800-824-0437.

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LETTERS

Ready to fight

It has been said again and again, but it also must be repeated again and again: Rural telephony needs the REA Program as well as the Standards and Engineering Div. of REA.

Rural telephone managers and owners started on a shoestring with revenues close to welfare levels. Only because of their dedication, years of hard work and the REA program do the rural communities of America have the very finest telephone systems.

Now, some people are proposing to eliminate the program and the Standards & Engineering Div. Are they mad? Why would anyone want to tear down a system that works? Adjust maybe—but not destroy.

The Western Rural Telephone Assn. (WRTA), an association dedicated to serve the REA borrowers within the Western (Alaska, California, Colorado, Guam, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, Utah, Washington, Wyoming) and the Southwest (Arkansas, Arizona, Louisiana, Missouri, New Mexico, Oklahoma, Texas) REA areas, will fight to the end to preserve and support the program that helped to make

them strong and independent. REA is necessary!

*Dolores L. Donnelly
Executive Vice President-Director
WRTA
Santa Rosa, Calif.*

New figures

I have just received the December 24 issue of TELEPHONY, and am particularly interested in the article titled, "Low density

telephony," (p. 38) and the coverage of China Comm 84 (p. 56).

My main objective in writing is to correct the section of the China Comm article that deals with Beijing telephones. An additional 60,000 telephones are scheduled for installation in 1985, a 50% increase over the number in service in 1984 which was 120,000. These figures have been confirmed to me by Beijing Telecoms staff.

*Doug Scholey
Airstocks
Kowloon, Hong Kong*

Correction

Table 2 in the article titled, "1985 world telecom spending—a struggle to stay even," in the Feb. 25 issue of TELEPHONY (p. 38) contained an error. The number of equipped lines for Spain should have read 9526 (million) not 1256 (million).

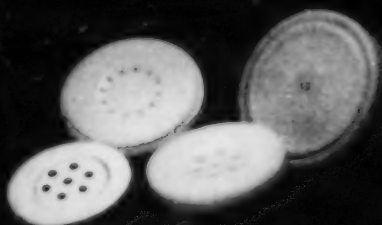
This also changes the total for Zones 3 & 4 to 143,568.3. However, the change represents only 1% of the worldwide total of phones.



"How many long distance calls are you making a month, Edith?!"

CALL CAROL FOR QUALITY & LOWER PRICES

Carol has years of experience making dynamic microphones. Now Carol is putting that experience to work for you to make telephone receiver-transmitters and handsets with quality up to international standards. The next time you call for telephones, why not call for Carol?



Big enough to serve many but too small to serve all

As sprawling as India's population and size are, so is its telecommunications system. However, while the system can serve many people, it still is too small to serve everyone

T.H. CHOWDARY

LIKE INDIA'S population and size, its telecommunications systems services are also sprawling and are often discussed.

Although India has the 10th largest industrial output and national economy in the world, its telecommunications are inadequate with only 3.6 million telephones or 0.48 telephones per 100 persons in contrast to the world average of over 12 telephones per 100 people. With more than 24,000 kilometers (km) of microwave radio routes, 18,000 km of coaxial cable and about 200,000 km of open wire carrier routes and more than 80,000 long distance telephone circuits, the telecommunications network facilitates about 20 million intracity and 5 million intercity calls per day, besides providing telex facilities in more than 176 towns and cities for about 23,000 subscribers.

The Indian telecommunications system is large enough to serve many people but too small to serve everyone. Approximately 800,000 applicants wait for a telephone, in some cases, for as long as 7 years.

The national telecommunications administration (PTT) of India is the second largest government undertak-

ing with a capital base of Rs. 35 billion (\$2.765 billion) and an annual income of Rs.12 billion. Its 250,000 workers, or 11 per 100 telephones, are both a strength and weakness. They are a weakness because of manual operations and a strength because of the potential for high turnout and significant achievement. With 28 earth stations and a domestic communication satellite and with 28 automatic exchanges, four of which are stored program controlled electronic exchanges, 250 towns and cities, and 65% of the main lines, are able to dial throughout the entire country.

To provide rudimentary telephone services in India's vast hinterland, a policy of providing public telephones to every community with a population of at least 2500 in underdeveloped areas and 5000 in other areas is practiced. So far, about 25,000 public telephones have been placed in the villages. They provide good communication up to the district level, which is the largest part of the villagers' needs.

There also is an extensive telegraph network with about 40,000 villages, towns and cities accepting and delivering more than 80,000 telegrams per day. In the larger cities, store and forward microprocessor controlled message switches are

being installed in increasing numbers to transit telegraph messages.

There is, of course, a relationship between per capita income and the number of telephones per capita. In developing countries, there are very rich people intensely engaged in economic activities and others who are just not drawn into the vortex of economic activity. It is estimated that in India at least 5% of the people are as rich today as the average person in Greece or Spain; for example, a total of 36 million people fall into this category. However, there are 3.5 million telephones for this segment of India's population; there would be at least 12 million phones for that segment if India's average was the same as Greece's or Spain's.

The urban population in India is about 25% of the total population, or about 183 million people. Their per capita income is much more than the national average. About 225 cities in India, each with a population of more than 100,000 people, have a total population of 107 million people and only about 2.9 million telephones or a 2.7% availability. This poor availability, even in the most intense centers of economic activity, is leading to poor telecommunications service. Evidence of the pressure on the telephone system is provided by the fact

T.H. Chowdary is Deputy Director General (MS), P&T Directorate, New Delhi, India.

Table 1
Investment in telecoms

Plan period	Investment in Rs. million	Percentage of internal resources
1951-56	470	21
1956-61	660	32
1961-66	1640	39
1966-74	4150	72
1974-79	11,890	73
1980-85	26,650	67
	45,460	

that in countries with better availability, 4 calls are made per main line per day; the figure in India is between 8 and 12. Those who have telephones use them intensely because they do not have as many as they want. Also, a recent business decision, regarding additional telephones for a person on the same premises, will require a deposit of Rs. 8000 and an annual rental of Rs. 1050. Those who do not have telephones use their neighbors' telephones.

The result is a very poor call completion rate. The number wanted is often found to be busy making or receiving calls; the caller also repeatedly and in quick succession is making call attempts, leading to overloading of the system and its rapid deterioration. In fact, only 33% to 40% of all call attempts result in conversations in the metropolitan cities.

In an attempt to extend national subscriber trunk dialing, realize the economies of alternate routing and provide additional facilities, old Strowger step-by-step exchanges are being phased out and crossbar exchanges are being introduced both at the local and trunk levels. Beginning with 1984, stored program controlled (SPC) analog electronic trunk exchanges for voice and digital exchanges for telex have also been introduced in the network. Even for local voice calls, about 50,000 lines of SPC analog electronic exchanges have been commissioned, and 170,000 lines on order.

With all this effort, it was expected that call completion rates would go up. However, because of the very large number of inefficient electromechanical exchanges still in the network, the improvement is not yet significant. For example, in Bombay, which has India's largest number of telephones—about 600,000—the electronic exchange capacity is 4.5%; crossbar exchanges are 62%; and Strowger step-by-step exchanges are 33% of system capacity. The re-

sult is marginal now. However, from one local electronic exchange through an electronic toll automatic exchange to another city with a local electronic exchange, the completion rate is 50% to 60%. In the telex network, there has been considerable improvement because more than 170 telex exchanges in the country are connected to one of four digital transit/local telex exchanges, so calls involving three links—that is, from one terminal exchange in one part of the country to another in another part of the country—have a completion rate of 70% to 80%, which is a remarkable figure.

Quality of service

The telephone is extremely valuable because long distance communication reduces transportation related delays. Indian managers and executives know what a great management tool telecommunications has been in the developed countries.

Sadly, the service is not satisfactory. While in many developed countries there may be one trouble report from a telephone in 2 to 5 years, in India normal trouble reports range from 4 to 12 a year. Because of the congested local and long distance networks, operator assistance is sought more often than anywhere in the world. For example, in the metropolitan systems, there are 4 to 10 calls to operator assistance per 100 telephone calls per day to get a local number.

Similarly, despite the availability of subscriber trunk dialing, tens of thousands of trunk calls are placed with operators. In Bombay and Delhi there are, on the average, more than

20,000 operator calls per day.

Huge numbers of operators are needed; in fact, they are the single largest class of telephone employees, constituting about 25% of all employees. The effort to improve the long distance subscriber dialing network and ease congestion is perpetual.

One reason for the high trouble report rate is the use of poor outside plant; cables, overhead drops and the wiring at the subscriber's premises. Because of limited availability of equipment and cables, almost every 2 years the same telephone exchanges are expanded; and, simultaneously, the underground cable network is expanded by digging up the streets and placing additional complement of cables, a process which carries with it the inherent hazard of damaging existing cables. Cable sheath punctures are revealed not in the good weather when they occurred but with the onset of the monsoon season, when water gets through them. Tens of thousands of telephones go dead. The entire network is thrown into disarray for weeks at a time. Pressurization of cables that are already directly buried has been used 13 years but has not made a significant difference except in one city for want of reliable compressor driers, leak detectors and pressure monitoring equipment.

Construction of underground cable ducts to avoid direct burial has been an accepted method for the past 14 years. But since it involves large capital expenditures and obtaining right-of-way authorizations from local authorities, progress has been slow. While in cities with many telephones, like Bombay, overhead wires and drops are disappearing, in most of the network, there are commonly four to five spans of overhead drop wires, especially in suburban and rural areas. There is endless trouble at distribution points, where the cable pairs are jumpered to overhead drops and overhead drops are terminated in the house.

The telephone instruments themselves are incessant source of trouble. About 85% of all the trouble in telephone services is found in the area from the distribution point to the subscriber's installation. Jelly-filled

Continued on page 40

'Because of the congested . . . networks, operator assistance is sought more often than anywhere in the world.'

cables now are being used in distribution cable and larger jelly-filled cables may be used in secondary areas.

Costs

The Indian PTT has completed six 5-year plans. During those 30 years, the number of telephones increased more than 40 times. A total investment of Rs. 44.5 billion had been made. The investment per telephone added has been going up from Rs. 5500 in the first 5-year plan to Rs. 20,000 in the sixth plan. In the sev-

Establishing manufacturing operations on this scale would be a challenge for any PTT in the world. It will be much more of a challenge for the Indian PTT which functions as a department of the government. A large amount of foreign cooperation to promote indigenous manufacturing would be involved. The indigenous electronic industry also would be profoundly affected.

While in many countries, the per main line revenue to the telephone company per year constitutes less

ing subscribers by including the capital cost of future works in the current price of telephone service.

Another good idea is to encourage a multiplicity of producers to make a variety of telecommunication equipment. Fortunately, the electronics industry is burgeoning in India and, in order to promote its accelerated growth, almost every state has set up an electronics corporation. In addition, there are hundreds of private producers. A national effort to develop quality telecommunications equipment is underway. The government's industrial policy resolution of the 1950s, which places responsibility for manufacturing telecommunication equipment in the government sector, has been liberally interpreted to permit private and joint private-public ventures to participate.

Because of the earlier restriction of knowledge and skills to a few government departments, private industry appears handicapped in envisaging the variety and quality of communication equipment that it could produce. There is a wide ranging search for foreign technical collaboration. At the same time, in order to restrict a bewildering variety of equipment types, with the related problems of spares, compatibility and continuing development, it is also believed that these technical collaboration agreements should be centrally directed and should ensure not more than two to three collaborators per product. The tremendous expansion envisaged in the seventh 5-year plan and afterward would open an unprecedented market in India for all equipment manufacturers. Manufacturers from around the world have not been slow in recognizing this point. There have been delegations of manufacturers from England, the United States, France and Canada to study the market and explore the possibility of technical collaboration with Indian manufacturers.

In many industrialized countries, growth in the number of telephones is slowing. In fact, in the United States, plain old telephone service is giving way to information age, enhanced services. This is not the case in the world's two most popular countries, China and India. Both countries can skip the evolutionary phases the more industrialized countries passed through.

With appropriate vision and good management, India can fully participate in the developing information age. □

'In many industrialized countries, growth... of telephones is slowing. In fact, in the United States, plain old telephone service is giving way to information age, enhanced services. This is not the case in... China and India. Both countries can skip the evolutionary phases the more industrialized countries passed through.'

enth plan, because of modernization and the emphasis on building an adequate long distance network, the figure is expected to go over Rs. 30,000 per main line. To add more than 4 million additional main lines, the investment in the seventh plan is estimated at Rs. 125 billion and it could increase because of delays and inflation. One feature of financing the plans has been increasing emphasis on internal resources, particularly from telephone revenues. The amount of internal financing has increased from 21% in the first plan to more than 70% (Table I).

The demand for main lines by the end of the seventh 5-year plan is estimated at more than 7.63 million. However, if telephones were provided within a year of application, the demand would be about 9 million and the demand for telex lines would be 90,000. With an increase in the number of phones, the opportunities for manufacturing and installing equipment also would increase.

Telegraph services would continue to be used in areas with few telephones. Large scale introduction of data services also is envisaged. Planned requirements are 5.9 million and 256,000 lines of local and long distance switching equipment, respectively.

than 5% of the per capita income of the country, in India it is 180% of per capita income. During 1983, several studies were made and discussions held to highlight the inadequacy of facilities and the penalty that the national economy is paying. The two most important views that emerged were that indigenous manufacturing capacity should be increased and new methods of funding should be found.

A decision has been made to set up two electronic switching factories; each will produce 500,000 digital exchanges lines per year. Construction of one factory in Mankapur in Uttar Pradesh is underway.

Dependence upon budgetary support and internal finance could restrict growth. Remedial steps suggested are similar to the method used successfully by the French PTT. The PTT would be allowed to raise investment money through bonds, leasing companies and the remarkable instrument of a National Bank for Telecom Development. If, by this method, enough finance is found for a 5- or 10-year period, the base of subscribers would considerably expand. From a large subscriber base it would not be difficult to realize sufficient internal resources without unduly depressing demand or burdening exist-

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Regulation and competition —Canadian style

MARC WINFIELD
and PERCY von LIPINSKI

AN IMPORTANT milestone in Canada's national development was reached in 1931 when the Statute of Westminster officially granted Canada sovereignty and independence from Great Britain. In that same year, an unincorporated association of major Canadian telephone companies was formed to construct a national long distance telephone network, the TransCanada Telephone System (TCTS). The TCTS would be Canada's interprovincial carrier and would make Canada as independent of American Telephone & Telegraph Co. (AT&T) as it was of Great Britain. TransCanada telephone calls would no longer have to be partly routed through the United States.

Today, the TCTS is called Telecom Canada. Its members are the nine major provincial telcos and Telesat, the country's satellite carrier. CNCP Telecommunications, a partnership of the telecommunications divisions of both private and government owned railway systems, is the only other interprovincial carrier. It provides telegraphic services in addition to private voice and data networks in certain provinces. Together, the revenues of CNCP and Telecom Canada accounted for more than 90% of the more than \$8 billion Canadian telecommunications carrier market in 1984.

Telesat provides Telecom Canada with the medium for some of the country's domestic interprovincial telephone traffic. In addition, it carries radio, television and data across Canada and to remote settlements. Owned by the federal government and the major carriers, Telesat was formed in 1969 and became a Telecom member in 1977. In 1982, with permission from International Telecommunications Satellite Organization (INTELSAT), Telesat arranged to handle certain transborder traffic in cooperation with U.S. satellite carriers. Until recently, Telesat was the only organization licensed to own and operate satellites in Canada. A recent ruling of Canada's federal regulators now permits private users to own and operate earth stations.

Overseas telephone service from Canada was inaugurated in 1927 with a call indirectly connecting Ottawa and London. In 1933, the first direct

channel overseas entered service. The Canadian Overseas Telecommunications Corp., now known as Teleglobe Canada, was formed in 1949 to administer and operate Canada's intercontinental telephone traffic. Teleglobe's most recent achievement was the 1983 completion of ANZCAN, the latest in a generation of high capacity undersea coaxial cables for long distance transmission. As an international carrier, Teleglobe is associated with INTELSAT rather than Telecom Canada. Like Telecom Canada, Teleglobe's monopoly on Canada's international carriage is soon to be challenged by the new interexchange carriers. The federal government now has Teleglobe up for sale.

A mixed grouping

The Telecom Canada member companies are a mixed grouping. Bell Canada is the largest, with almost 60% of the telephones in Canada. It is a wholly owned subsidiary of Bell Canada Enterprises, which holds significant equity in the principal telcos of each of the Maritime provinces: New Brunswick, Nova Scotia, Newfoundland and Prince Edward Island. In the Prairie provinces, each of the principal telephone systems is owned and controlled by its respective provincial government. The second largest telco in Canada, the British Columbia Telephone Co. (BC Tel), is owned and controlled by GTE Corp., Stamford, Conn. In addition to Telecom's members, there are more than 150 other smaller, independent telephone systems in Canada, many of them municipally owned, operated and regulated.

In their own operating territories, the telcos have a monopoly on public switched telephone voice services. Canada's major telcos, collectively making up Telecom Canada, are the country's monopoly carrier of interprovincial public telephone traffic. Public message services are a nationwide monopoly service of CNCP. The remaining interprovincial services for video, data and private voice transmission are a market shared to varying degrees by both Telecom Canada and CNCP.

As monopoly suppliers, Canada's
Continued on page 60

Marc Winfield is Vice President of Operations and Percy von Lipinski is President, Com-Link Communications Ltd., Vancouver, British Columbia.

telcos have been able to offer their noncompensatory universal local service by cross-subsidization from their more profitable services: private lines and long distance. For Canada's seven publicly traded telcos, operating profits (before taxes and debt charges) averaged more than 25% of their revenues in 1984 (not including those of subsidiary operations). The overall average of those revenues come from long distance charges. As in the United States, long distance revenues have enjoyed a growth rate exceeding that of inflation.

Canada enjoys a significant place in the early history of telecommunications and telephony. Alexander Graham Bell, a Canadian, invented the telephone in Ontario. The world's first long distance call was also made in that province in 1874.

The first trans-Atlantic radio signal was sent by Marconi from Newfoundland in 1901. In recent years, Canada finds recognition as a world leader in the manufacture of telecommunications equipment. Considering this and its position as a wealthy, developed nation, it stands to reason that Canada's nationwide telecommunications network should be advanced and its administration progressive (see Figure 1).

Long distance competition

Ironically, the development of the Canadian long distance telephone network has, in a sense, gone full circle. Again, transCanada telephone and data traffic is being networked across the border for part of its travel. Companies in the United States are again taking a portion of the revenue from Canadian long distance calls to points within Canada and a larger portion than they normally would be due for calls made into the United States.

Legislators and Canadians involved in the telephone industry might only have imagined such an occurrence under the duress of wartime invasion or other disaster when the long-established lines of communication within Canada had been severed. This seems unusual when telephonic communications within Canada have suffered no physical interruption, relations between Canada and its southern neighbor are at their best in 15 years and, in general, the trade balance with the United States weighs heavily in Canada's favor.

In fact, there are two conflicts in process. They are economic in nature

Table 1: Major Canadian Telcos Share of Carriage Market (%) and Regulatory Agencies

Telelobe Canada	2.0	federal government
Bell Canada	51.9	CRTC
BC Telephone Co.	12.0	CRTC
CNCP Telecommunications	3.6	CRTC
Telesat Canada	0.7	CRTC
Northwestel	0.6	CRTC
Terra Nova Telecommunications	0.4	CRTC
Alberta Government Telephones	9.8	Alberta Public Utilities Board
Saskatchewan Telecommunications	1.5	Saskatchewan Public Utilities Review
Manitoba Telephone System	2.9	Manitoba Public Utilities Board
New Brunswick Telephone Co.	2.3	New Brunswick Public Utilities Board
Maritime Tel and Tel Co.	2.8	Nova Scotia Public Utilities Board
Island Telephone Co. Ltd.	0.3	Prince Edward Island Public Utilities Commission
Newfoundland Telephone Co. Ltd.	1.3	Newfoundland Public Utilities Board
Edmonton Telephones	1.8	City of Edmonton
Northern Telephone Ltd.	0.3	Ontario Telephone Service Commission
Quebec Telephone	1.7	Régie des services publics du Québec
Télébec Ltée	1.0	Régie des services publics du Québec
Thunder Bay Telephone System	0.2	Ontario Telephone Service Commission

but neither one is across the border. One has existed for the past 8 years between the ubiquitous U.S. other common carrier (OCC) and resale operations striving for a competitive edge to ensure their survival in the stabilizing U.S. long distance market. The other is being waged in Canada's legislative forums over the extent to which telecommunications should be deregulated or reregulated. Concerned parties, aside from the Canadian public who will be affected by any change in regulation, include two groups. On one hand, there are several corporate entities with an interest in cutting long distance expenses or in entering the toll market for profit. On the other, there are the consumer groups and the telcos interested in maintaining the long-standing tradition of universal service.

In the United States, the window of opportunity for new long distance companies has all but closed. Competition is fierce in a marketplace that no longer offers niches for newcomers and is rapidly squeezing out many late arrivals. Existing companies vie for what market segments remain and strive to include as much of the international traffic as is possible and permitted by the regulators concerned.

National telephone systems are independent of one another to a large degree. Therefore, the only factor

that can influence the relative costs of the same service in both Canada and the United States is pressure from representatives of business who cite the "better" system as an example to promote or discourage change. For the majority of individuals who have to pay the rates, the objectivity in determining the needs and criteria for change is lost.

For the telephone industry, regulation was a byproduct of its inception. Regulation has existed for more than 100 years, although it is only since the Carterfone decision 18 years ago that regulation has become a widely-touted public issue. In Canada, aside from media acknowledgements of developments south of the border, the issue of deregulation in the public spotlight is a far more recent phenomenon. It may in fact have been brought about by another hotly debated Canadian communications issue: the reception of U.S. television signals that stray across the border and their effect on Canadian social, cultural and even economic sovereignty from the United States.

A regulatory mosaic

Following the invention of the telephone in Canada and the subsequent rapid growth of telcos throughout Canada, regulation was enacted as in the United States to provide universal service. Nevertheless, a definitive

and consistent policy for telecommunications regulation was never established and the result was a patchwork of regulatory agencies. Canada has been referred to as a regulatory mosaic. The manner of regulation for Canada's telcos was determined to a great degree by historical accident.

It might have bypassed the most pressing need for consistency in regulation, that being to improve if not, enforce, communication between the provinces regarding their role in the overall network of Canadian telecommunications. Currently, the DOC's role in the telephone industry is to set the standards and approve user-

stricted to a 100-mile wide corridor along the U.S. border. Therefore, the Canadian government's concern about the effects of U.S. television and radio programming are somewhat warranted. Similarly, the relatively rapid improvements and developments in the U.S. telephone and data network make it increasingly attractive to Canadian business, which is as eager as its counterpart south of the border to reap the benefits of better technology, services and prices as soon as they become available.

It may be a bitter irony for Canada that regulation has restricted emerging businesses or corporate interests from starting several years ago to replace the old, microwave transCanada relay with a modern, even fiber optic, system that would not only meet Canadian needs but could have surplus capacity available for sale to U.S. customers. The latter prospect would have been, and is perhaps still, attractive because of the U.S. dollar's strength in foreign markets.

Seen from the other side of the 49th parallel, the Canadian telecommunications service industries are a potentially attractive market for U.S. manufacturers. However, foreign trade tariffs are too restrictive so Canadian telcos tend to buy Canadian. On one hand, these policies and their consequences benefit Canada's economy, but seen from another viewpoint, they serve to reinforce the adversity of the climate for competition in even the most widely deregulated sector of the telephone industry. Partial parallels might be drawn be-

'In their own operating territories, the telcos have a monopoly on public switched telephone services. Canada's major telcos, collectively making up Telecom Canada, are the country's monopoly carrier of interprovincial public telephone traffic.'

For the most part, regulatory bodies operate at the level of government that corresponds to the serving area of the telcos they regulate (Table I). Many exceptions exist. BC Tel in its early years chose to be federally regulated. Because of its nationwide telegraph network, CNCP's several telco subsidiaries which operate within the bounds of single provinces or territories are also federally regulated. Bell Canada is an anomaly in the pattern as its serving area comprises two provinces instead of one. Because of the interprovincial scope of its coverage, it is federally regulated.

The federal regulator in each aforementioned case is the Canadian Radio-television and Telecommunications Commission (CRTC). The CRTC oversees all rate increases as well as setting broadcast and telecommunications policy. The CRTC is responsible to the Dept. of Communications (DOC), Canada's nearest equivalent to the U.S. Federal Communications Commission (FCC).

For almost 90 years, government policy with regard to telecommunications had been to do little more than set price guidelines and pay homage to the virtue of providing universal service.

It was not until 1969 that the DOC was formed. Until then, the regulation of Canadian telecommunications was determined by largely insignificant, loosely-worded sections of the Federal Railway Act. If organized earlier, the DOC might have paved the road to more consistent regula-

tion. It might have bypassed the most pressing need for consistency in regulation, that being to improve if not, enforce, communication between the provinces regarding their role in the overall network of Canadian telecommunications. Currently, the DOC's role in the telephone industry is to set the standards and approve user-

owned terminal equipment manufactured in Canada. Certainly, for almost 15 years, the nationalization policy of the Liberal government had a strong retarding effect on foreign investment in Canada. Fortunately, Canada benefits from its reputation as a leader in telecommunications interconnect technology. Canadian switching, transmission and terminal equipment finds an eager market worldwide.

Ironically, Canadian telecommunications manufacturers, except those owned by the telcos' parent companies, have had trouble selling their goods in Canada. Because of broader deregulation, they have found a more open market in the United States. Even after the institution of interconnect reregulation in those areas of Canada overseen by the CRTC, competitive manufacturers have often struggled unsuccessfully to break the equipment monopoly. Amid rumors of drastic underbidding and saddled with unusually high operating losses, newly-created, competitive telco subsidiaries have continued to dominate their market and, in that sense, maintain their monopoly. In Canada's Prairie and Maritime provinces, the telcos still retain a monopoly that tends to be upheld by the respective provincial regulators.

Canada's unique demographic situation is worthy of mention here, especially in terms of its economic repercussions. The population of Canada is only one tenth that of the United States but for all Canada's vastness, 90% of its population is re-

'The manner of regulation for Canada's telcos was determined to a great degree by historical accident.'

tween this situation and the Japanese government's controversial decision to deregulate the national telecommunications system or the U.S. government's continuing dilemma over the importation of Japanese automobiles.

Competition on the service side of

the telephone industry is a recent occurrence in Canada. For the most part, it is only an issue, not a reality. With only one public switched network, that of Telecom Canada, there are, in a sense, neither OCCs nor true resellers of long distance telephone service operating in the country at present. This last point requires some explanation.

Two companies in British Columbia, Cam-Net Inc. and Longnet Communications, have been reselling the services of U.S. carriers to Vancouver long distance users. For access to these services, a long distance call across the U.S. border is required. Customers receive long distance bills from both BC Tel and the Vancouver reseller which acts as billing agent for the U.S. carrier. Nevertheless, with the BC Tel and U.S. OCC charges combined, users were able to realize savings usually on the order of 5% to 20%, that is, until April 1985.

When Longnet and Cam-Net began operating, BC Tel had appealed to the CRTC for permission to block

their calls. This appeal was denied and for a year, the two companies increased their small customer base. However, a subsequent application by BC Tel was granted approval by the CRTC. BC Tel was permitted to lower its rates for long-haul calls to the United States and raise them for the short-haul, that is, Cam-Net and Longnet access calls into the state of Washington. The mainstay of the Vancouver resellers' operations had come to a practical end.

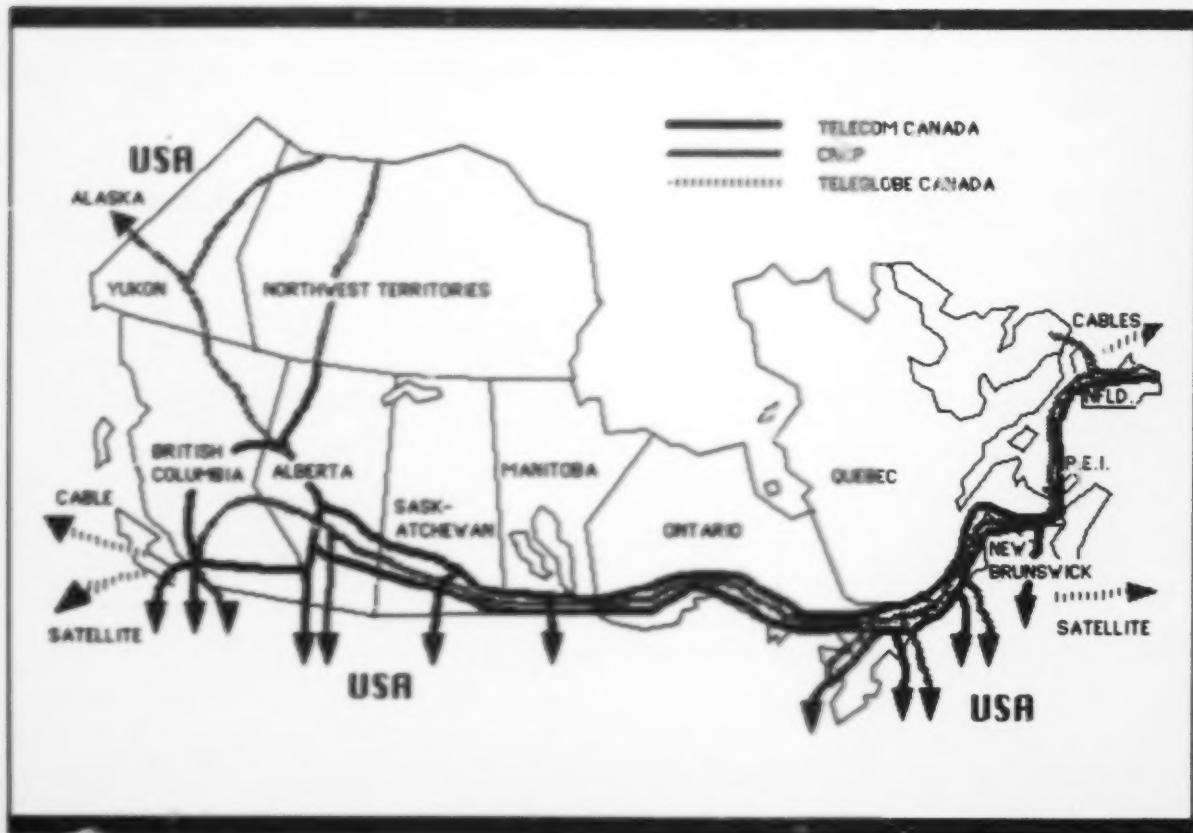
Acting more swiftly than BC Tel against the promise of competition, Bell Canada offered business customers its own discount long distance service for calls going into the United States. Teleplus 1022 is a special dialing plan that permits authorized subscribers to route U.S.-bound calls through MCT's network rather than AT&T's. For the high volume business subscriber, the results are savings comparable to those of Cam-Net and Longnet.

In 1979, the CRTC had permitted CNCP to interconnect its facilities with Bell Canada for the provision of private long distance lines. This form of telco bypass was cost effective for only the largest of corporations. By CRTC regulation, British Columbia opened to private networks in 1981,

permitting CNCP access to Canada's three largest cities. However, those areas not under CRTC regulation, that is, the Prairie and Maritime provinces and international telecommunications, have remained immune to CNCP's incursion. In the already limited market for private-line voice networks, the situation for CNCP is far from competitive even though it now has what might be termed the monopoly on competition with Telecom Canada.

Recently, CNCP and Com-Link Communications Ltd. have announced plans to enter the long distance market in competition with Telecom Canada. All three have announced their intention to implement transCanada fiber networks. CNCP also wants to expand its private voice network into new areas of Canada. In 1984, the CRTC began hearings, known as the Interexchange (IX) Proceedings, on the issue of competition in the Canadian long distance marketplace. CNCP and Com-Link submitted their applications as interested parties wanting to begin operations as Canada's first OCCs. To date, no other companies have so formally entered their proposals but a number of parties have announced publicly their interest in establishing

FIG 1 Major Canadian telecommunications arteries.



competitive long distance telephone networks in Canada.

Local service worries

The telephone industry has recently entered the Information Age. Public switched networks support voice in digital or analog format and data communications, the latter in increasingly greater proportion. Through the advent of stored program controlled switching, the process of billing has become less expensive and simple enough to implement local measured service (LMS) in conjunction with any or all other forms and plans of subscriber billing.

In conjunction with the rate rebalancing that has arisen in the United States as a direct result of competition in the long distance market, there have been concomitant plans to introduce LMS. Where zone usage measurement is in effect, of course, rates have gone up.

In Canada, the threat of LMS has received understandably negative publicity. Spokespersons for consumer associations and unions have suggested worst-case scenarios following the proposed proliferation of competition in the telephone industry. For instance, in metro areas such as Vancouver where the free calling area is large, the inevitable introduction of LMS by the serving telco will have considerable social and economic effects. Part of the negative public reaction is fear of the unknown. The remainder is the result of the inculcations by proponents of a monopolistic telephone industry. Lo-

not have to come to an end.

Local rates have increased almost everywhere in the United States over the past 8 years, typically 10% to 50%, but not to the extent once forecast by monopoly proponents. Where even these modest rate increases have threatened to financially burden low-income ratepayers, spe-

ment. Logically, being its largest trading partner, neighbor and ally, Canada feels this influence more than any other nation. Canada is part of the North American numbering plan and so it should with the high volume of traffic that goes between it and the U.S., approximately 150 million calls annually.

'It may be a bitter irony for Canada that regulation has restricted emerging businesses or corporate interests from starting. . . years ago to replace the old, microwave transCanada relay with a modern, even fiber optic, system that would. . . meet Canadian needs. . . .'

cial rate categories have been created to preserve the universal service maxim. Many U.S. telcos now offer lifeline services to bona fide low-income subscribers and LMS-type billing for low-volume callers. In the final analysis, it is doubtful that the effects of rate rebalancing and its many permutations will sink small businesses or force low-income households to forfeit their telephones. The U.S. example, so frequently and perhaps even deliberately misinterpreted in Canada, has shown this to be so. Also, Canada's deregulatory situation has and will continue to benefit from the mistakes and lessons

The U.S. telecommunications industry has undergone what some have termed a revolution in recent years. Although Canada cannot and should not be exactly like the United States, its communications policies and regulation will have to adjust to the new climate. Change is inevitable.

Politics may be an unavoidable consequence in the provision of a fair and reasonable communications policy but it cannot be the central issue. The duty of telecommunications companies and government is to serve the public first. It may be in those interests that, years from now, much of the existing regulation will be dropped or at least waived with the advent of lower cost telecommunications and an industry that is competitive in all its aspects.

The Canadian reaction to a new world in telecommunications is well underway. The instilling of competition in its long distance market is one of the last remaining steps. Whether the allowances for competitive long distance will be tolerant of new businesses or so restrictive as to exclude all possible competitors but the most favored, has not been established. It will be incumbent on the federal government to establish the guidelines for this introduction. However, before proceeding, the federal and provincial conflict for authority in the telecommunications sector must be settled. If necessary, the present regulatory bodies must be modified to provide even representation and jurisdiction. □

'Telesat provides Telecom Canada with the medium for some of the country's domestic interprovincial telephone traffic. In addition, it carries radio, television and data across Canada and to remote settlements.'

cal monthly service rates may increase. Telcos may obtain approval to charge more for use of their telephone lines for data communication (for which Bell Canada has already applied to the CRTC). Long distance access charges may soon be levied on some or all Canadian subscribers. But reasonable telephone rates do

learned in the United States.

Within an industry, the rapid advance of technology and changing socioeconomic conditions have little effect on one another but without, these two influences alter living standards and government policy. The United States is responsible for much of the world's change and develop-

telephony

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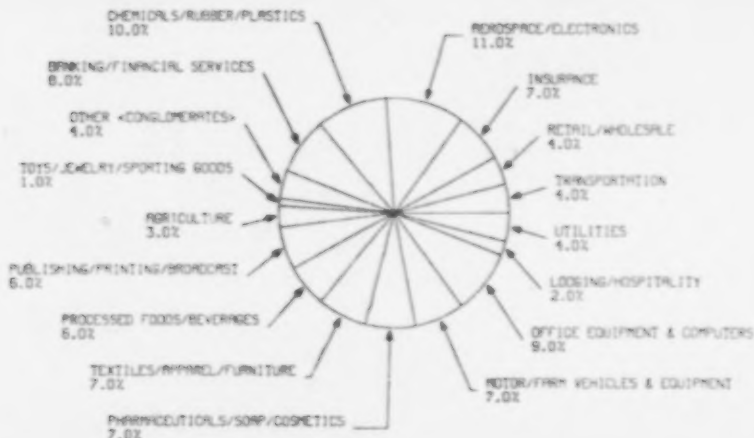
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Big business = big bucks in telecommunications

Figure 1 Fortunes: return by Industry group



CZATDANA INAN,
MARKET RESEARCH DIRECTOR

The Fortune results have been derived from the first 10% of return from the headquarter location of the Fortune 1000 industrials and Fortune 400 service organizations that is representative of the Fortunes' headquarters distribution throughout the United States.

BIG BUSINESS is paying its own way for the opportunity to choose among vendors of equipment and network services. It is an opportunity most big users fervently want. Large businesses have long had the voice and data communications traffic volume to create efficiencies in leased and purchased systems. They now have the in-house expertise. Some even have become vendors themselves, such as Eastman Kodak, Citibank, General Electric, International Harvester and Sears, which are offering access space on their own networks. Most, however, are concentrating on using telecommunications as a tool to achieve the objectives of their primary business.

Today's business user is on the frontier of an information society. Nearly half of the large PBXs purchased in 1983 and more than half of those purchased in 1984 were capable of handling data. Only 1 office in 20 in the U.S. today is equipped with a personal

computer. That is expected to grow to one in two offices by 1989 with the voice/data personal computer-based workstation commonplace. Equipment and network service suppliers hope that all of these computers will be communicating computers—increasing the traffic on the network.

ICA (International Communications Assn.) surveys, conducted 2 years apart, calculate the overall average for telecommunications expenses across U.S. industry as 0.74% of sales and 0.95% of expenses, up from 0.51% and 0.65%, respectively, in 1981. This is an annualized increase of more than 13% based on sales and expenses. Most businesses can justify one full-time salaried staff professional for each \$1.2 million in annual expenditures for telecommunications equipment and network services and one hourly person for each \$1.8 million, excluding switchboard operators.

These factors translate into multi-bil-

lion dollar budgets. The 500 largest Fortune industrials, for example, posted 1984 profits of \$86.4 billion on sales of \$1758.7 billion. They spent \$13 billion to \$16 billion in 1984 for telecom equipment and network services, based on 1983 factors. Indeed, \$16 billion is probable because these industrials contain the greatest concentration of multinationals among the Fortunes. The factors portray the typical 500 Industrial with a \$32 million telecom budget and a staff of 21 full-time telecommunications professionals.

Business has every incentive to deploy in-house management when annual telecommunications expenditures reach \$1.5 million. Small businesses (under 80 lines) are turning to professional consultants as voice and data transmission technology and choices become increasingly more complex. Users of large interstate, and increasingly, intrastate networks already

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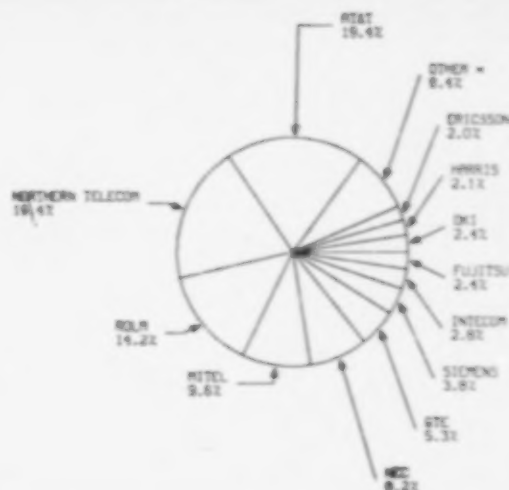
manage their telecommunications functions in-house. The Fortune industrials and service organizations exemplify users of large interstate networks while the top 20% of hospitals (over 300 beds) and universities (4-year institutions with more than 2500 students) exemplify large intrastate users. Telecom management typically operates from headquarter and main campus sites. But interstate and intrastate users markedly differ in their current emphasis on integrated planning.

Only 25% of the major universities and 12% of the major hospitals have integrated their voice and data communications functions, according to Telephony Publishing Corp.'s fourth annual 1984 survey of large users. This year's survey showed little increase in voice/data integration in hospitals and universities while the percentage climbed to 72% among the industrials and 60% among the service organizations. This is well in line with the 1986 levels of 75% and 64%, respectively, predicted by the Fortune respondents in the 1984 survey. A total of 92% of the industrials and 73% of the service organizations will be nearing completion of their voice/data integration during 1986-87. The current planning approach is primarily responsible for the spreads in budget size, staff size and training between interstate and intrastate users. The Fortunes are setting the pace for organizations that have yet to begin full-scale integrated planning.

Setting the pace

The Fortunes' decisions are determining the outcome of the war between manufacturers for office controller supremacy. Manufacturers on both sides are admitting they cannot be all things to all users. International Business Machines Corp. (IBM) has acquired Rolm; British Telecom is in the process of acquiring Mitel; and GTE Communications Systems is expected to announce a joint venture this fall with a major office automation supplier. American Telephone & Telegraph Co. (AT&T) has a stake in Olivetti and there are scores of compatibility agreements, targeting the voice/data market. Having good equipment is not enough in a consolidating market. Equipment must be sold to the market. Users with sophisticated requirements—backed by multi-million dollar budgets—will determine who will succeed.

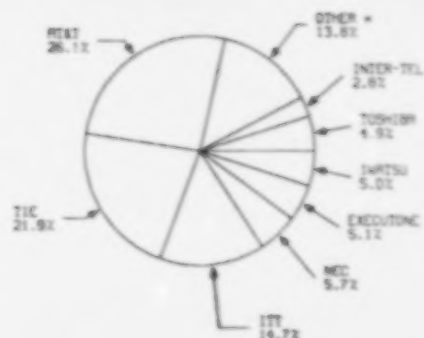
Figure 2 1984 Total PBX shipments: 4,847,945 lines



Source: Northern Business Information, New York, NY

Other: 1.7% United Technologies, 1.4% Solid States Systems and Hitachi, 0.3% IPC, 2.3% all others.

Figure 3 1984 Total KTS shipments: 4,737,580 stations



Source: Northern Business Information, New York, NY

Other: 1.9% Fujitsu, 1.7% Isotec, 1.5% Walker, 1.2% Pan Orient, 0.9% Telrad and Northern Telecom, 0.8% Crest and R-Tec Systems, 0.7% Thomson-CSF, 0.6% Teltone and Teletec, 0.5% Northcom, 0.4% Eagle, 0.3% Tone Commander, 0.2% PKS Communications and Gai-tronics, 0.1% Comdial, 0.6% all others.

The war for office controller supremacy is over, according to the 140 Fortunes selected for analysis in Telephony's 1985 large user survey (Figure 1). They are concentrating on switching data through their PBXs and expect

15% to 20% of their lines to be data by 1987. Both local area networks (LANs) and PBXs are seen as data handling solutions; existing coaxial cable and twisted pairs account in part for this. But LANs will be the favored solution

for computer-to-computer communications; PBXs, for dial-up applications. Consolidation of data networks has current priority over the integration of voice and data networks among more than half of the industrials and service organizations.

The Fortunes are determined to call their own shots in a voice/data environment. Median average staff size is 12 full-time professionals, with 9 out of 12 having voice and data communications training and experience. Capital expenditure requests typically cover 3 years into the future, including estimated paybacks. In addition to keeping treasurers happy, the planning cycle allows implementation of controls to ensure the anticipated benefits flowing from capital expenditures will be realized.

Approximately 75% of industrial and 85% of service organization total annual expenditures for equipment and network services are allocated by head-quarter-based telecom management. The difference is due to the weight of multinationals among the industrials and banks among the service organizations. U.S. banking regulations currently discourage nationwide interstate banking and so the expansion of major banks and their need for in-house controlled interstate networks.

Equipment acquisitions account for approximately 40% of total budgets. Determination of need for new, replacement and additional equipment, its evaluation and vendor selection are all the responsibility of headquarters telecom management. Voice equipment, including key systems, PBXs and associated telephone equipment, accounts for 58% of equipment spending. An additional 25% is spent for data communications equipment, including modems, multiplexers, front-end processors, voice/data workstations and data PBXs. Administrative equipment comprises 17% of budget and includes automatic call distributors, local area networks, facsimile, voice messaging, call accounting and the like.

The Fortunes' reported 1985 equipment budgets are realistic. Extrapolating their reports and using the 20/80 rule (20% of the market accounts for 80% of dollars) yields a total market of \$13 billion. Dataquest (San Jose, Calif.), which tracks 34 related mar-

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Table 1 Composite of top 9 non-affiliated interconnects

	Sales (\$000,000)		
	Est. 1985	Actual 1984	Actual 1983
Telecom Plus International	\$300.00	\$160.00	\$106.0
RCA Telephone Systems Div.	105.0	102.4	102.5
Universal Communications Systems	81.0	64.9	52.6
Communications Corp. of Am. (CCA)	72.0	62.1	46.1
Honeywell Communications Services	73.0	65.0	56.0
Norstan Communications Systems	100.0	31.8	25.3
Hankels & McCoy/Telecom Systems	35.0	34.0	26.0
Jarvis Corp.	35.0	26.7	24.5
Standard Telecommunications Systems	23.0	20.0	18.0
	\$824.0	\$566.9	\$457.0

Estimated by Telephony

(a) includes Compath

(b) includes revenues of Norstan Information Services and Electronic Engineering Co.

Table 2 Dominant 1984 PBX Manufacturers versus major interconnect distribution

Dominant PBX manufacturers (and 1984 PBX lines shipped)

	AT&T—804,060	Northern—901,715	Rolm—661,000	Mitel—446,756	NEC—380,000	GTE—245,970	Siemens—176,700	Intercom—132,000	Fujitsu—112,248	OKI—110,700	Harris—96,837	Ericsson—92,400
9 Major Non-affiliated												
Communications Corp. of Am.	X			X								
Hankels & McCoy/Telecom Systems	X		X	X	X	X				X		
Honeywell Comm. Services Div.					X	X						Xa
Jarvis Corp.						Xb						
Norstan Communications Systems			X									
RCA Telephone Systems Div.				X								
Standard Telecom Systems	Xc			X	X					X		
Tel-Plus of Telecom Plus				X		X						
Universal Comm Systems				X								
Regionals' Subsidiaries												
Advanced Systems	X	X		X				X	X			
Ameritech Communications	X	X		X								X
Bell Atlantic Systems	X			X				X				
Firstel Information Systems				X				X				
Nynex Business Info. Systems		X				X		X				
PacTel Communications		X								X		
Southeastern Bell Telecom	X			X				X	X			
Independent Affiliates												
Center Business Systems Executive	X	X	X			X					X	X

Sources: PBX line shipments, Northern Business Information (New York, N.Y.) interconnects and PBX product lines, Telephony Publishing Corp.

(a) Delta-Plus 2000, Honeywell Ericsson Development Co.

(b) Siemens PD162

(c) Maintain and Upgrade SL-1

kets, estimates the 1985 equipment market at \$13.7 billion. Using the above groupings, 63% accrues to voice equipment; 20% to data communications equipment and 17% to administrative equipment.

Consolidation

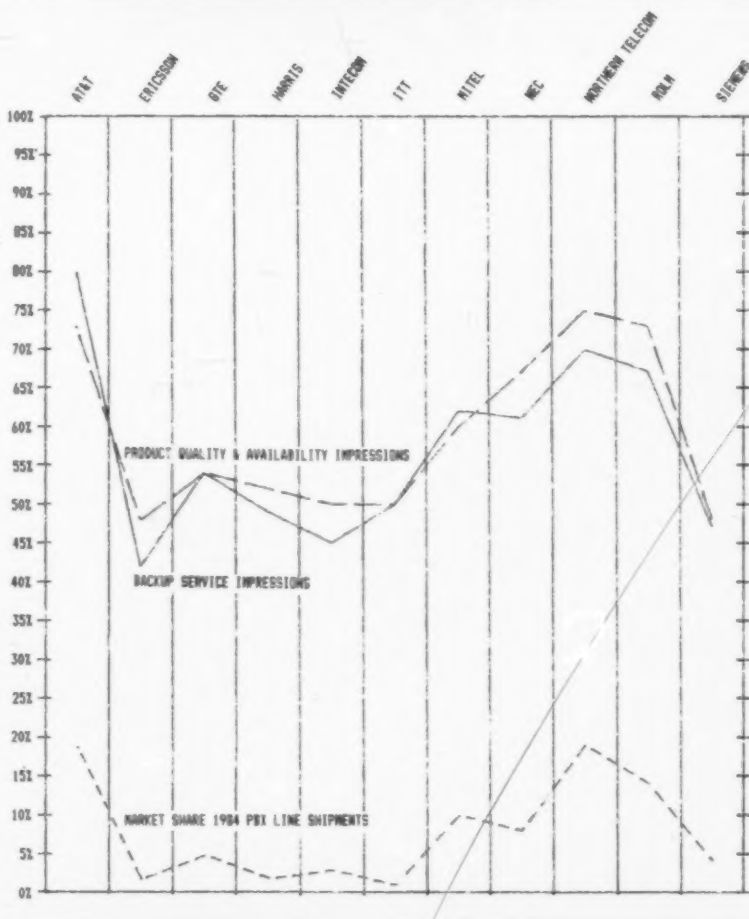
Barring manufacturer sales, only two dozen interconnect companies currently are positioned for serious competition for the market offered by the Fortunes and major hospitals and universities. Among them are the subsidiaries of the seven regional holding companies, which posted first-year 1984 sales of about \$800 million. Centel Business Systems, one of the largest Independent holding company affiliates, had 1984 sales of \$215 million, up 12% from \$192 million in 1983. Sales for the nine largest interconnects that are not manufacturer or holding company owned neared \$600 million in 1984 and will easily pass \$700 million in 1985 (Table 1). These 22 interconnects are parent to 20% of the estimated 5000 interconnect locations in the U.S.

Small interconnects face tough competition that is going to get tougher. Operating margins are shrinking and their window of opportunity is closing. Wishful thinking about the demise of Centrex has been superseded by concern for its new appeal. Full service retail distribution channels, offering small system installation and maintenance, pose a grave new threat.

Three of today's top 25 interconnect competitors are full service retail distributors. Tandy Corp. now has 130 Radio Shack Telephone Stores and Tandy recently introduced its own key system, designed for small business, which can accommodate up to 8 lines and 36 stations. United Telecom now has more than 30 AmeriSource stores, with more openings scheduled. Although AT&T has its own stores, there already are at least 150 Sears Business System Centers that offer AT&T equipment. Tandy, Sears and AmeriSource offer a range of voice, data and administrative equipment designed for small and medium-sized businesses.

Between the extremes are established interconnects doing business in limited areas of the 12 key interconnect states in the U.S. Among them are Gray Communications in Pennsylvania, Telespec Voice & Data Systems (for-

Figure 4 Fortune headquarters impressions of major PBX competitors and 1984 PBX line shipments market share of competitors



Manufacturer impression rated 3-excellent, 2-average, 1-poor. Ratings are based on total points as percent of maximum points (respondent Base x 3).

Shipments: Northern Business Information (New York).

merly Long Island Sound Systems) in New York, and J. Livingston Co. and Chicago Communications in Illinois. Many are diversified. Chicago Communications also installs and maintains cellular and private two-way radio equipment and has established paging divisions in six Florida metropolitan areas. Many have unexpected partners. J. Livingston Co. markets Centrex service for Illinois Bell and recently completed a project in Tucson, Ariz. with GTE. All are in enviable positions. They

can opt to expand, consolidate their current base or entertain buy out suitors.

The fierce competition for a greater share of the large user market has prompted a flurry of interconnect mergers and manufacturer and interconnect alliances. Thomson-CFS has a stake in Communications Corp. of America; Siemens in Telecom Plus International's Tel-Plus. Norstan is in the process of acquiring Electronic Engineering Co., a deal that will give Norstan

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\$100 million in 1985 combined sales. Bell Atlantic acquired an established interconnect base in the booming Southwest with the purchase of Texas-based Telecommunications Specialists, Inc. CommTel (Charlotte, N.C.) has been acquired by BellSouth. BellSouth projects its nine-state area will be an \$815 million market by 1990.

None of the major interconnects or equipment manufacturers have pinned their hopes for market share on growth alone. There are no signs of explosive growth or runaway demand, as small interconnects had hoped. Each expects a share of growth, of course, but the major objective is a greater share of the billions of dollars spent each year by users of large interstate and intrastate networks.

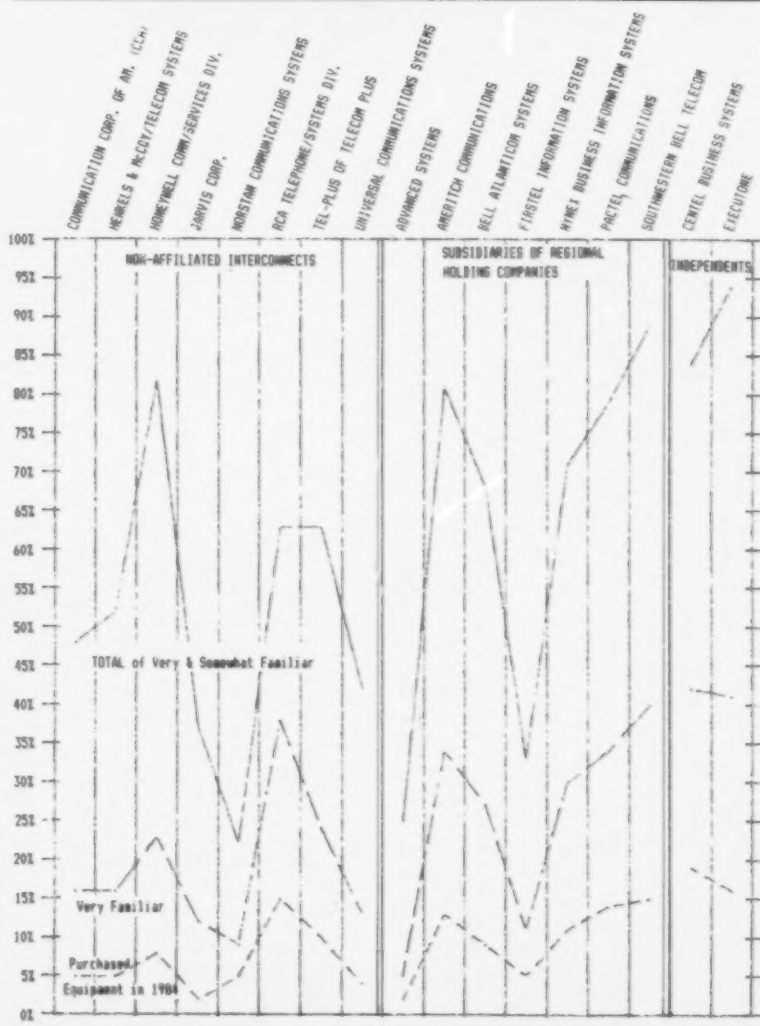
Where the money is

Willie Sutton claimed he robbed banks only because "that's where the money is." Large business users are where the money is in today's market. Large users are generally concentrated in limited geographic areas and the major interconnects and manufacturers are converging on these commercial centers.

Twelve states are the mother-lode of interconnect. New York, Pennsylvania, Illinois, Texas and California account for 40% of the business phones in the continental U.S. Seven additional states complete the "dazzling dozen" of interconnect. Four of the seven—Connecticut, Maryland, Massachusetts and New Jersey—join New York along the path of corporate headquarters that curves along the U.S. northeast corridor. Ohio and Michigan, together with Illinois, form the hub of the midwest industrial belt. Florida, Texas and California offer booming economies and a base of expansion into nearby states' commercial pockets.

The five-state Midwest area, for example, has more phones than any country except Japan. It has more computer sites than any other region—19% of the U.S. total. If California were an independent nation, its economy would rank eighth on the world scale, just behind Italy and ahead of Canada. One in 10 households in California already has a home computer. New York is home to the largest number of Fortune headquarters in the U.S. User concentration also is true of sparsely popu-

Figure 5 Fortune headquarters familiarity with major U.S. interconnects and whether purchased equipment from them during 1984



Base: 128 Fortune corporations (92 industrials; 36 service organizations).

lated states. In Colorado, 16% of business customers account for 87% of business long distance revenues. Just 3% of business customers bring in 47% of toll revenues.

Interdependence

All of the major interconnects are positioned for competition in the voice/data market. A key factor in their growth has been distribution of voice equipment.

Voice equipment and network services still dominate user budgets.

Irrespective of distribution channels, the voice and data communications market is dominated by relatively few suppliers. Northern Business Information (New York) is one of the more thorough trackers of PBX and key system shipments. It estimates 4.6 million PBX lines were shipped in 1984; five

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manufacturers account for 80% of shipments (Figure 2). The pattern is the same in the key system market; with seven manufacturers handling 80% of the shipments (Figure 3).

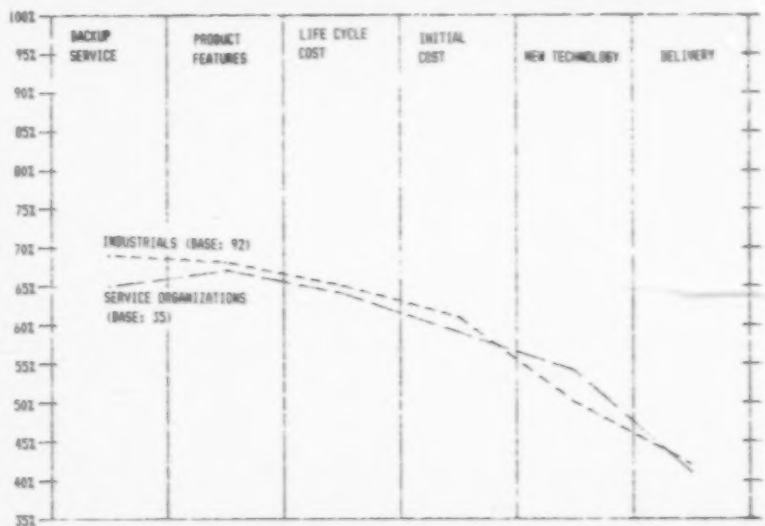
Large users, however, have made distribution channels as important as the equipment manufacturer. The major interconnects have successfully penetrated the voice/data market of the major hospitals, universities and the Fortunes. This fact is not lost on manufacturers. Communications Corp. of America, for example, counts Hyatt Hotels, Amoco Oil, Federal Express and American Express among its customers. Universal Communication Systems' customer-base includes the universities of New Mexico, Oklahoma and Tennessee and American Electric Power. Henkels and McCoy/Telecom Systems already had installed more than 12 million telephones and associated hardware for telephone operating companies prior to divestiture, in facilities ranging from small to big business, hospitals, universities and government agencies.

Large user requirements compel far-ranging manufacturer and interconnect alliances. A key system customer rarely generates major peripheral equipment sales. Large users, however, want more than just a switch. Users are demanding offers of end-to-end equipment and service. This demand will force the Federal Communications Commission (FCC) to relax some Computer II restrictions on the Bell local exchange companies to allow network as well as interconnect solutions to communications needs. The successful interconnect in today's market is selling planning capability, not just hardware.

The Fortune participants in Telephony's 1985 survey rated 30 voice and data communications manufacturers, based on their impression of the vendors' overall product quality and availability, backup service and management. The impressions are indicative only of the vendors marketing success. But comparison of large user impressions of the major PBX vendors and 1984 shipments shows correlation between user perceptions and actual performance (Figure 4).

The participants also were asked how familiar telecom professionals in their nationwide organization are with

Figure 6 Order of importance of purchase criteria



Corporate headquarters telecom management rated each category on a scale of one to six, where six (6) was most important. Ratings were not duplicated. Percentages are based on maximum possible points that could be scored in each category. Maximum possible category points among industrials is 552 (92x6); service organizations, 210 (35x6).

major interconnects and whether they had purchased equipment from any during 1984. Again, the results are indicative only of marketing success but show correlation between user perceptions and actual performance (Figure 5).

The results underscore established links between major PBX manufacturers and interconnects (Table 2). Links also are being established with major manufacturers of data communications and administrative equipment. Distribution of administrative equipment from manufacturers such as Summa Four is as common to the major interconnects as equipment from IBM, Rixon, Codex, General Datacom, Micom, Paradyne and Timeplex.

Like it or not, the interconnect market is consolidating, following the same pattern as that of the telephone operating companies. There were literally thousands of small operating companies at the beginning of century. By 1985, 98% of U.S. lines were served by the regional holding company telephone groups and the top 20 Independents. Unlike regulated markets, open markets swiftly punish inefficiency.

Current user impressions and shipments lull few suppliers into complacency. Corporate top management wants results for the money spent on in-house telecommunications. Budgets and staff size increased 10% to 15% annually during 1982-1984 and will remain at similar levels over the 3 years from 1985-87. Internal strength now counteracts backup threats. Though backup still ranks among the primary purchase considerations, its margin of lead over product features and life cycle and initial costs has plunged (Figure 6). Purchase by intimidation is becoming extinct.

Corporate top management is demanding that telecom management use the means and authority conferred to carry out operational responsibility. That also has resulted in a truce in the less-publicized war for office supremacy.

Neither telecom nor MIS groups will win the battle to dominate the other in the integrated environment. The sniping of these groups in the past few years has prompted top management to have them report on a separate but equal

Continued on page 44

basis when not formally consolidated.

Determination of need for new, replacement and additional equipment, its evaluation and vendor selection are all completed by telecom management before approval of capital expenditures is sought (Figure 7). Executive committees and corporate top executives review and approve capital expenditures—as guardians of the corporate coffer.

They do not second-guess vendor selection. Promotion directed to corporate top executives, however, may elicit the question, "Is XYZ Co. being considered?" The 3-year capital request horizon ensures that qualified vendors are reviewed throughout the procurement cycle.

The bottom line

Corporate top management control over capital expenditures may be circumvented but only temporarily and at great peril.

The telecommunications director of a large user wields a multi-million dollar budget, and has the power to cause acute corporate embarrassment. For example, the Chicago Mercantile Exchange has filed suit against its former telecommunications director, saying it was bilked out of \$250,000. The alleged act was part of a \$625,000 transaction that involved the purchase and maintenance of 5308 telephone handsets and 5308 confidencers (microphones that screen out extraneous noise). The suit charges the former director set up his own corporation to act as a middleman between the supplier and the exchange.

The telephone system in the 18-month old Mercantile building, however, meets rigid specifications established when the facility was built. And a membership survey taken earlier this year indicated that the telephone equipment in question got above average marks from users. Therefore, the system of checks and balances did not break down at the technical level, where deviations would be discernible to the professionals involved in determination of need, evaluation and vendor selection. The fancy footwork was in the area of capital expenditures—the fiduciary responsibility of corporate top management. The dark-side of their responsibility is cognizance of the more devious human activities.

Figure 7 Telecom purchasing hierarchy of Fortune companies

INDUSTRIALS (BASE: 87)

DETERMINE NEED		
Voicecom	Datacom	
35%	30%	Telecom
52%	54%	Staff
11%	15%	Managers
98%	99%	VPs/Directors
0%	0%	Corporate
2%	1%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

EVALUATE EQUIPMENT & NETWORK SERVICES		
Voicecom	Datacom	
36%	31%	Telecom
54%	58%	Staff
9%	10%	Managers
99%	99%	VPs/Directors
0%	0%	Corporate
1%	1%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

SELECT VENDORS		
Voicecom	Datacom	
33%	27%	Telecom
51%	59%	Staff
15%	13%	Managers
99%	99%	VPs/Directors
0%	0%	Corporate
1%	1%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

APPROVE CAPITAL EXPENDITURES		
Voicecom	Datacom	
0%	0%	Telecom
6%	6%	Staff
26%	26%	Managers
32%	32%	VPs/Directors
37%	37%	Corporate
31%	31%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

SERVICE ORGANIZATIONS (BASE: 27)

DETERMINE NEED		
Voicecom	Datacom	
33%	33%	Telecom
37%	41%	Staff
15%	19%	Managers
93%	93%	VPs/Directors
0%	0%	Corporate
7%	7%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

EVALUATE EQUIPMENT & NETWORK SERVICES		
Voicecom	Datacom	
41%	44%	Telecom
37%	41%	Staff
15%	11%	Managers
93%	93%	VPs/Directors
0%	0%	Corporate
7%	4%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

SELECT VENDORS		
Voicecom	Datacom	
15%	19%	Telecom
44%	52%	Staff
30%	26%	Managers
89%	96%	VPs/Directors
0%	0%	Corporate
11%	4%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

APPROVE CAPITAL EXPENDITURES		
Voicecom	Datacom	
0%	0%	Telecom
7%	7%	Staff
26%	26%	Managers
33%	33%	VPs/Directors
44%	44%	Corporate
22%	22%	Board/Exec Comm/CEO
		VPs of Adm, Fin, Optns

The bottom line for equipment and network service suppliers is that corporate telecommunications management is clearly going about its business with

the full backing of corporate top management. And their budgets give them awesome power in determining the future of vendors. □

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Time division digital switches: a progress report on installations in North America

Table 1

North American time division digital switching (YE 84)

System	ITT North 1210	GTE No. 3 EAX	No. 5 EAX	NEC NEAX 61	STROM DCO	DMS10	NTI DMS 100 200 300	TRW VID ITS 4 5	AT&T TECH. No. 4 ESS	No. 5 ESS	ERICSSON AXE 10	CIT ALCA E10-5	Totals
1. Base units in service YE 84													
a) Total Units	179	30	201	141	503	1011	565	183	116	85	4	5	3023
b) End Offices	164		201	120	467	1011	288	125	N.A.	75		5	2456
c) Intermediate Offices	1	27		4	6		110	17	108	1	1		275
d) Combined Inter- End Office	14		5	17	28		138	41	N.A.	9			252
e) PABX-CPE/ Reseller-OCC			1	N.A.	5		24						30
f) International Gateway					1		1		8		1		11
g) Mobile Radio				3	2		4				2		11
2. Number of remote switching units in service YE 84	70	N.A.	140	99	337	246	453	N.A.	N.A.	26			1371
3. Thousands of total lines in service YE 84	938	N.A.	2000	533	1018	1450.9	4668.4	319	N.A.	1000	8.3	5.6	11,941.2
4. Thousands of trunks in service YE 84 (For Intermediate and Combined Intermediate End Offices)	100	191		128	123	N.A.	1010.5	368	3505	39	21.5		5486

Table 2

North American time division digital switching (YE 84) Largest Offices in Service by System

System	Local	Intermediate	Local toll
	Location	Lines	Location
1210	So. Fort Myers, Fla.	17,280	Charlotte Amalie, Vt.
DCO	Cheshire, Conn.	10,044	Elko, Nev.
DMS 10	Camden, Del.	6880	
DMS 100	Newton, Mass.	55,580	Montreal
(family)			
E10-FIVE	Monrovia, Ind.	2000	
EAX 3			Calgary, Alberta
EAX 5	Lincoln, Neb.	44,604	Oberlin, Ohio
ESS 4			Los Angeles
ESS 5	Lexington, Mass.	31,400	Milwaukee
NEAX 61	Hesperia, Calif.	12,813	Chicago
			Trunks
			Location
			Terminations
			Roseville, Calif.
			Middleton, Wis.
			Kitchner, Ontario
			Lafayette, Ind.
			Fredrick, Md.
			Ridgecrest, Calif.

For the past 4 years, Amos E. Joel Jr., formerly of AT&T Bell Laboratories and now an executive consultant for AT&T Technologies, has been providing TELEPHONY with hard data on progress made in installing time division digital switches in North America. This report includes the results for 1984, which are present as Tables 1 and 2. It also includes the data for 1983, presented as Tables 3 and 4; the data for 1982, presented as Tables 5 and 6; and the data for 1981, presented as Tables 7 and 8. Tables 1, 3, 5 and 7 include information on which types of digital switches were installed and their size and location. Tables 2, 4, 6 and 8 include information on the largest offices of each type of equipment. Tables 3, 4, 5, 6, 7 and 8 most recently appeared in TELEPHONY, July 9, 1984, pp. 55-57. Tables 5-7 appear on pp. 70 and 71.

Table 3

North American time division digital switching (YE 83)

System	ITT/ North 1210	No. 3 EAX	No. 5 EAX	NEAX 61	DCO	DMS 10	DMS 100/200/300	ITS 4/5	No. 4 ESS	No. 5 ESS	AXE 10	E10-5 (TSS)	Totals
1. Base units in service YE 83													
a) Total	191	27	75	104	402	794	384	183	99	13	1	2	2274
b) Class 5	137		68	77	375	778	215	125	NA	11		2	1687
c) Class 4/5	44		6	19	22	15	92	41		2			241
d) Class 4	10	27		3	5	1	35	17	99				197
e) PABX-CPE			1	N/A			8						9
f) International gateway					2		3	1		(8)			3
g) OCC tandem				3			32				1		36
h) Mobile radio													
2. Number of remote switching units in service YE 83	95	NA	5	68	208	189	276	319		NA			960
3. Thousands of total lines in service YE 83	712	NA	550	410	739	1181	2800	368	NA	66		3	7429
4. Thousands of trunks in service YE 83 (all classes)	66	233	21	77	96	7	500	23	2975	5			4003

N/A - Not available

NA - Not applicable

Table 4

North American time division digital switching (YE 83) Largest Offices in Service by System

System	Local		Toll		Local/toll	
	Location	Lines	Location	Trunks	Location	Terminations
1210	Jefferson City, Mo	20,140	Jefferson City, Mo	2324	Roseville, Calif	4000
DCO	Cheshire, Conn.	10,000	Boscobel, Wis.	1000	Middleton, Wis.	10,800
DMS 10	Harrison, Ark.	6300	Redmond, Ore	800	Cheyenne, Okla	1700
DMS 100	Toronto	40,000	Montreal	29,900	Butler, Pa.	27,120
family						
EAX 3			Calgary, Alberta	15,360		
EAX 5	Lincoln, Neb.	25,000	Oberlin, Ohio	883	Lafayette, Ind	10,888
ESS 4			Los Angeles	71,000		
ESS 5	Bradford, Pa.	12,000			Leesberg, Va	13,000
NEAX 61	Victorville, Calif.	13,752	Winter Park, Fla	5640	Thomaston, Ga.	10,246

Table 5
North American time division digital switching (YE 82)

System	ITT North 1210	No. 3 EAX	No. 5 EAX	NEAX 61	DCO	DMS 10	DMS 100/200/300	ITS 4/5	No. 4 ESS	No. 5 ESS	Totals
1. Base units in service YE 82											
a) Total	163	36	10	78	292	612	263	183	90	2	1729
b) Class 5	111		10	63	286	597	148	125		2	1342
c) Class 4/5	42			13	5	11	67	41			182
d) Class 4	10	36		2	1	1	27	17	90		184
e) Other							21				21
2. Number of remote switching units in service YE 82											
On base units	75			49	141	145	248	319			977
3. Number of total lines in service YE 82	573K	25K		323K	509K	896K	1857K	308K		3K	4494K
4. Number of trunks in service YE 82 (Class 4 or 4-5)	57K	204K		16K	53K	3K	297K	19K	2713		3362K
5. Total systems and lines on order or expected YE 83											
Systems	N/A	39	650	145		1175	550	N/A	98	N/A	
Lines	N/A	N/A	3M	320K		1.5M	5M		NA	N/A	
Trunks	N/A	250K	NA	139K		NA	700K		N/A	N/A	

* = 525 remotes
N/A - Not available
NA - Not applicable

Table 6
North American time division digital switching (YE 82) Largest Offices in Service by System

System	Local		Toll		Local/toll	
	Location	Line	Location	Trunks	Location	Terminations
ITT North 1210	Jeff. City, Mo.	20K	Jeff. City, Mo.	2.3K	Roseville, Calif.	4K
No. 3 EAX	NA	NA	Calgary, Alberta	5.8K	NA	NA
No. 5 EAX	First Colony, Texas	6K				
NEAX 61	Victorville, Calif.	13.7K	Winter Park, Fla.	5.8K	Thomaston, Ga.	10.4K
DCO	Ville Platte, La.	7.5K	Boscobel, Wis.	1K	Middleton, Wis.	10.8K
DMS 10	Harrison, Ark.	6K	Pearce, Ariz.	250	Pinetop, Ore.	2.1K
DMS 100/200/300	Toronto	43.5K	Toronto	23K	Kitchener, Ontario	40K
ITS 4/5*	St. Mary's, Ga.	7K	Gander, Newfoundland	1.2K	Mauston, Wis.	6.5K
No. 4 ESS	NA	NA	Los Angeles	70.4K	NA	NA
No. 5 ESS	Cedarville, Ohio	2K				

NA - Not applicable
* - 1981 data

Table 7

North American time division digital switching (YE81)

System(s)	No. 4 ESS	ITS 4/5	DCO	DMS 10	No. 3 EAX	1210	DMS 100/200/ 300	NEAX 61	Totals
1 First service	1/76	3/76	7/77	10/77	3/78	9/78	4/79	5/79	
2 Base units in service as of year end (YE) 1981									
a) Total	74	165	219	443	33	112	150	47	1243
b) Class 5	NA	125	214	441	NA	77	92	33	982
c) Class 4/5	NA	22	4	(1)	NA	27	34	12	99
d) Class 4 only	74	18	1	2	33	8	24	2	162
3 Remote switching units in service YE 1981									
a) Total	NA	315	131	98	NA	50	63	29	686
b) On base units	NA	315	131	98	NA	50	63	0	657
c) On remotes	NA	NA	N/A	N/A	NA	NA	NA	29	29
4 Total lines in service YE 1981	NA	180K	380K	616K	NA	375K	910K	187K	2648K
5 Trunks in service YE 1981 on Class 4 or Class 4/5 offices	2174K	70K	37K	NA	149K	35K	137K	10K	2612K

NA—Not applicable
N/A—Not available
(1)—Included in Class 5

Table 8

North American time division digital switching (YE 81) Largest Offices in Service by System

System	Location	Local Lines	Location	Toll Trunks	Location	Local/toll Terminations
No. 4 ESS	NA	NA	Houston	59.3K	NA	NA
ITS 4/5	St. Mary's, Ga.	5.6K	Gander, NF	1.2K	Mauston, Wis.	6.5K
DCO	S. Katy, Texas	7K	Boscobel, Wis.	1K	Middleton, Wis.	10.8K
DMS 10	Harrison, Ark.	5.1K	Redmond, Calif.	406	N/A	N/A
No. 3 EAX	NA	NA	New Westminster, B.C.	13K	NA	NA
1210	Jefferson City, Mo.	20K	Glenwood, Ark.	2K	Roseville, Calif.	13K
DMS 100/200/300	Runnymede, Ontario	43.5K	Montreal	27.7K	Kitchener, Ontario	41.2K
NEAX 61	Victorville, Calif.	11.8K	Winter Park, Fla.	3.5K	Ridgecrest, Calif.	8.8K

NA—Not applicable
N/A—Not available